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for the drilling-producing-pipe line industry

PETROLEUM REFINER and The REFINERY CATALOG
for the refining-natural gasoline industry

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J. E. KASTROP; CECIL SMITH; M. E. POOLE, K. B. CROUCH; E. J. HIGGINS; V. M. ORTS
3301 Buffalo Drive, Houston 6, Texas

HENRY OZANNE
250 Park Ave.
New York 17, N. Y.

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W. W. Wilson Bldg.
Huntington Park, Calif.

ANTHONY GIBBON
Hunt Bldg.
Tulsa 3, Okla.

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CHARLES WYATT
3301 Buffalo Drive
Houston 6, Texas

CIRCULATION DEPARTMENT

CLINTON S. QUIN, JR., *Manager*

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Established 1916 as THE OIL WEEKLY

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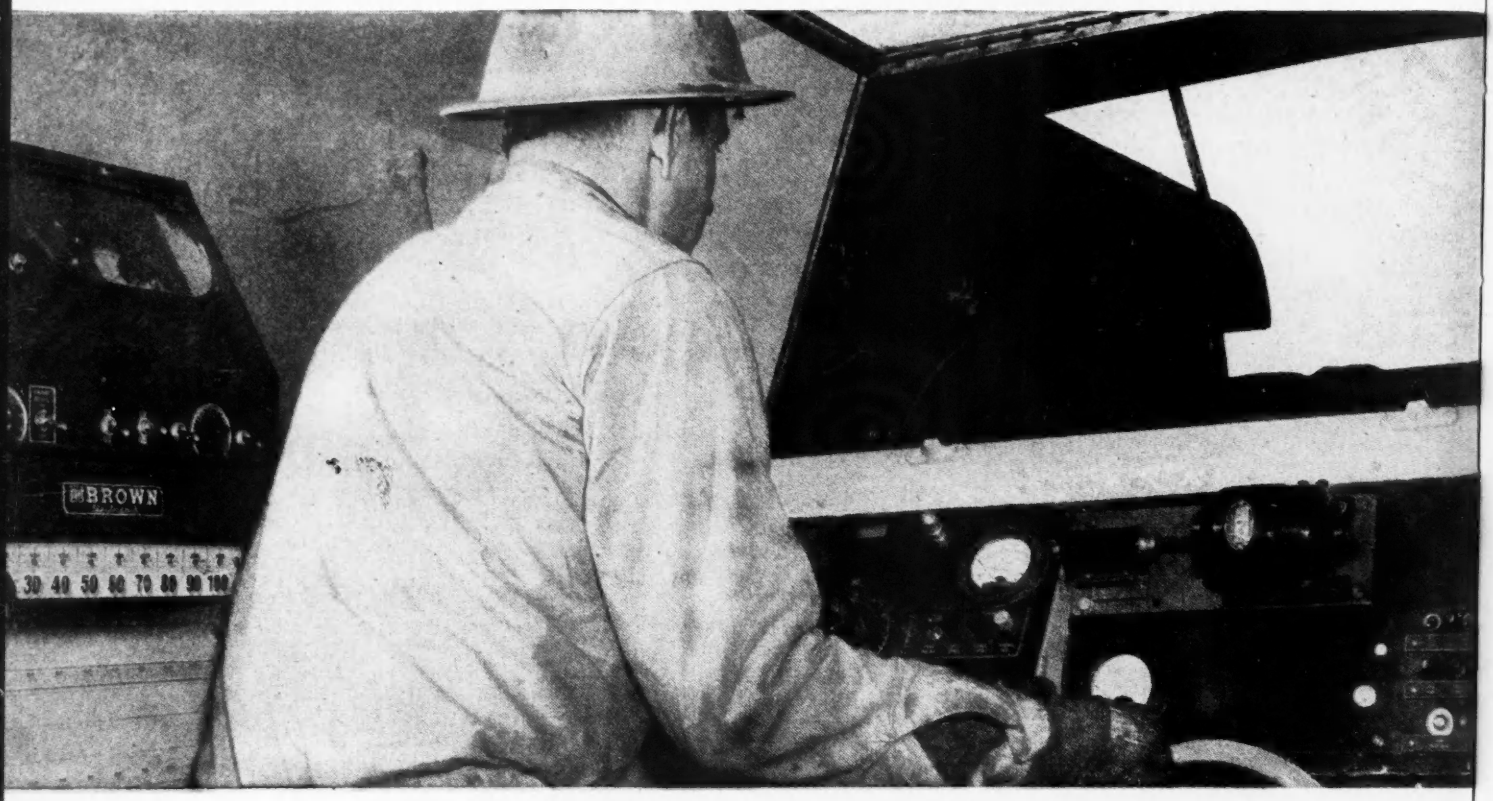
Looking for a "Dam Site"!

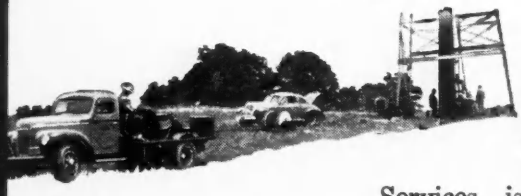
The successful shut-off of water in producing wells depends on the accurate location of the points of entry—and the application of suitable plugging materials.



Interior of an Electric Pilot truck showing the instruments which enable Dowell Engineers to "look" into the bottom of a well.

Dowell's Water Locator finds points of water entry

Dowell's Plastic Service provides effective control



The object of Dowell's Water Locator—one of the Electric Pilot Services—is to give an accurate location of the points of water intrusion in wells. The method employs the latest electrochemical apparatus and techniques, and has an impressive record of success.

Dowell Plastic Service provides a modern, effective method of controlling water-oil ratios after the points of water encroachment have been found. The liquid plastics used are applied by either bailer or squeeze techniques and change to *impervious solids* to form an excellent seal.

Ask the nearest Dowell station for your free copy of the new, illustrated booklet describing all of the "Electric Pilot Services." Inquire also about other Plastic applications, Selective Acidizing and Chemical Scale Removal Service for heat exchange equipment. Bulk materials: Jelflake, Paraffin Solvents, Inhibited Hydrochloric Acid.

DOWELL

DOWELL INCORPORATED • TULSA 3, OKLAHOMA

Subsidiary of The Dow Chemical Company

Look to

DOWELL

FOR OIL INDUSTRY CHEMICAL SERV

SUPPLY PROBLEM BEING SOLVED

THE PETROLEUM INDUSTRY is doing a most remarkable job of furnishing U. S. consumers with enlarged quantities of its products. During the first half of 1948 supplies of domestically produced crude oil, natural gasoline, and benzol, plus imports, amounted to 559,000 barrels more per day than during the corresponding period of 1947. This boosted supply to a level 45 percent greater than the prewar peak.

This volume was sufficient not only to meet sharply higher consuming rates, but at the same time to permit substantial and needed additions to stocks in this country. Approximately 15 million barrels of refined products were added to storage during the past six months, an average of 86,000 barrels daily. This illustrates the improvement achieved by the industry in catching up with growing demand, for in the initial half of 1947 stocks were reduced more than 10 million barrels or 58,000 barrels daily. Building up of stocks in the face of a 7.2 percent gain in demand was a most noteworthy achievement.

Greater current output coupled with this expansion in stocks presage that the industry will need only a moderate additional increase in production and refinery runs to satisfy heavier consumption requirements during the forthcoming winter. Thus, the industry should be able to avoid the shortages which occurred the past winter. If any scarcities develop next winter, they will be due to distribution troubles, and surely will be very local in character and of short duration.

Every sign indicates the industry will continue to improve the relationship of supply with demand. To further improve the supply situation the industry is drilling the greatest number of wells in history. Present indications are that the industry will complete between 38,000 and 39,000 wells during 1948. This will be from 3000 to 4000 more than in 1937, heretofore the most active drilling year. This means about 5000 more wells will be completed in 1948 than in 1947.

From these figures, and others presented in the Mid-Year Review articles published in the Current Outlook Section of this issue, it can be seen that the industry already is solving the problem of providing sufficient supplies of petroleum to fulfill expanding consumption.

The problem is being solved by the forces of free business rivalry. Although politicians, professors and Congressional Committees have constantly debated during the past three years what should be done to enhance the nation's supply of petroleum, they are no nearer a decision today than when they started. While these groups were merely talking about the matter, competitive private business has been doing things to actually enlarge the nation's petroleum supply. This is indeed fortunate. Given a fair chance, the forces of free business rivalry will continue to do as much in the future.

SURVEY RESULTS

A SURVEY MADE by the Petroleum Equipment Suppliers Association clearly reveals that a great majority of the oil industry equipment manufacturers and suppliers prefer that the International Petroleum Exposition be held not oftener than once every four years.

The PESA asked its members, all exhibitors at the recent IPE show, and also a few other representative concerns how frequently they wanted the International Petroleum Exposition held. Replies totaled 393, or 65 percent of the total of 602 questionnaires which were mailed out, and gave these results:

Once every 4 years .....303 or 77 %
Once every 3 years .....45 or 11½%
Once every 2 years .....45 or 11½%

These results may differ slightly from the earlier survey made by the International Petroleum Exposition itself, the outcome of which has not yet been made public. This is indicated because some of the PESA replies stated they had previously voted for more frequent shows on the IPE survey, but meanwhile had changed their views. However, the difference between the two surveys probably will be relatively small. The PESA survey would indicate that the IPE survey also resulted in the majority expressing a preference for an exposition once every four years.

The PESA survey expresses the wishes of a group which is extremely important to the exposition, the exhibitors and prospective exhibitors who "foot the bill." The replies received were sufficient to constitute an adequate sample. Evidence of deep feeling on the matter was indicated by the number who affixed comments and even lengthy letters to their questionnaires, although these were not requested. Quite a number expressed opposition to any other show than the IPE. Some stated they were voting for an exposition at Tulsa every three years merely to kill the chances of another show being promoted elsewhere.

If only a small majority had favored having the exposition at four year intervals, comparatively little importance would need to be attached to the results of the survey. However, with such an overwhelming preference for an exposition not oftener than once every four years, it behooves the officials and directors of the IPE to give the question most careful consideration before any dates are fixed for holding the next exposition.

Warren L. Baker

ARE THESE THE QUESTIONS you would ask about any packer?

CAN IT BE DRILLED UP EASILY?—The Baker Retainer Production Packer is completely drillable. You will never have to "mill up" a Baker Packer.

DOES IT RESIST CORROSION?—Yes, the cast iron construction of the Baker Packer is far more resistant to corrosion than the steel casing in which it is set.

IS THE PACKER INSTALLED AS PART OF THE TUBING STRING?—Not the Baker Retainer Production Packer which virtually becomes a part of the casing when it is set. The tubing can be pulled and run-in again as often as is necessary.

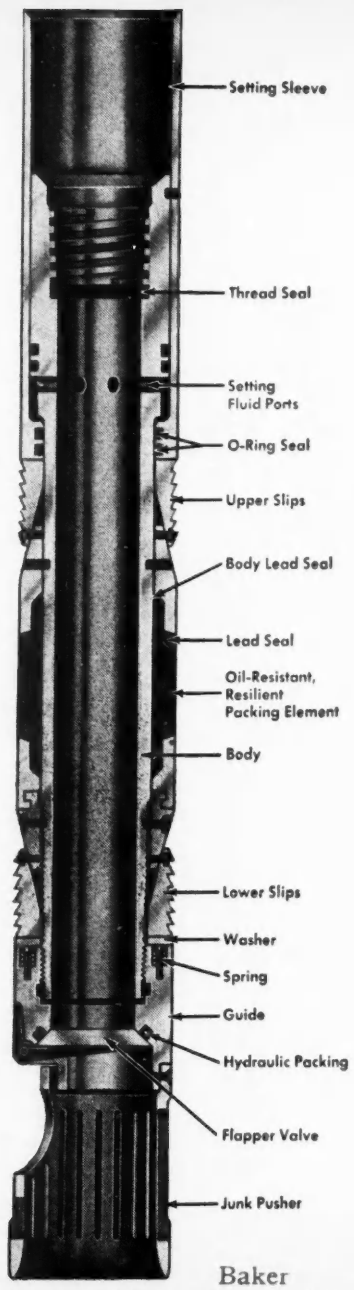
DOES IT HOLD BOTH WAYS?—Yes; Baker Packers are anchored against either upward or downward movement by two full sets of opposing slips.

DOES IT REQUIRE "SET-DOWN" WEIGHT?—When it is desirable, the tubing can be suspended in tension, thus eliminating the possibility of "corkscrewed" tubing which would hinder or prevent dropping pressure bombs, or other similar operations.

DO YOU HAVE TO REMOVE THE PACKER TO GUN-PERFORATE OR CLEAN OUT BELOW IT?—Not the Baker Retainer Production Packer, which is equipped with a positive-sealing, flapper type back-pressure valve. This flapper valve opens readily to permit the downward passage of tubing or tools, but closes instantly to hold safely against back-pressure when the tubing (or tools) are being removed from the well.

IS IT ADAPTABLE TO SEVERAL APPLICATIONS?—Yes; to practically all applications, and to all operating procedures. Single-zone or two-zone hook-ups are possible to meet any production requirement. The Baker Retainer Production Packer also is ideal for water-injection or flooding re-pressuring, re-cycling, testing, acidizing, gas-lift, and many other applications.

WHO MAKES THIS PACKER, AND HOW CAN I GET MORE INFORMATION ABOUT IT?—The Baker Retainer Production Packer (Product No. 415-D) is made by Baker Oil Tools, Inc., and Baker representatives are stationed in all active areas to give you prompt and intelligent service. Get in touch with your nearest Baker man today.



Baker
Retainer Production Packer
Product No. 415-D

BAKER
OIL TOOLS, INC.
Houston • Los Angeles • New York

BAKER
RETAINER PRODUCTION
PACKER

The Changing Panorama

U. S. Security Demands Foreign Sources of Oil

AVAILABILITY OF OIL from foreign sources is highly essential to the national security of the U. S., asserts Howard W. Page, executive assistant to the president of Standard Oil Company (New Jersey). He shows that U. S. national security cannot be assured simply through the development of domestic petroleum reserves and operations, despite the importance of a large and healthy domestic industry.

In a statement made public in mid-July, Page said that in view of the present interest in national security problems, he thought it was desirable that the public should be informed of the facts regarding operations during the recent war. He is qualified to discuss the subject through knowledge and understanding of worldwide oil movements that he gained as director of the program division of the Petroleum Administration for War.

The principal petroleum problem of the recent war was transportation, said Page. Enemy submarines caused loss of tankers and reduced effectiveness of remaining tankers, as convoy operations sharply increased turnaround time. With transportation scarce, it became imperative to make the most efficient possible use of tankers by securing oil supplies from the nearest sources.

Maximum effectiveness of use of tankers dictated schedules of production, refining, and distribution. Supplies for India were allocated to the Persian Gulf refineries because that involved the shortest haul. Supplies for the Central Pacific were obtained first from California to the extent available and secondly from the Caribbean area. Shipments were made to the Central Pacific from the U. S. Gulf Coast only if supplies were not available elsewhere. The Caribbean represented a shorter haul source for all Atlantic and Pacific operations than the U. S. Gulf Coast.

The foreign oil properties of both American companies and those of our Allies were absolutely indispensable to winning the war, declared Page. Operation of these properties permitted shorter tanker hauls than if the materials had been obtained from the U. S. This resulted in meeting military requirements which could not have been met from the U. S. even if ample U. S. oils had been available. Persian Gulf sources were indispensable to the Pacific operations, as there were not enough tankers to supply these military needs from other sources. Caribbean oils were urgently needed when large-scale movements through the Panama Canal became necessary to supply Central Pacific operations.

In the first half of 1945, at the height of the war, there was a daily average demand of 2,353,000 barrels daily for military and bunker grades of petroleum for the world excluding Russian and Axis-controlled areas. Of this amount only 1,528,000 barrels daily or 65 percent came from U. S. sources. Foreign supply sources provided the other 35 percent of military and bunker demands after taking care of essential foreign civilian demand.

In any future emergency, as in the recent war, said Page, the problem of supplying essential U. S. civilian requirements, ships' bunkers at U. S. ports, and on-shore U. S. military demands should be relatively simple. The difficult problem comes in supplying the off-shore military requirements in addition to esential foreign civilian demand and ships' bunkers.

The supply sources for these off-shore demands are of great importance, asserted Page. The Caribbean is a shorter haul source to all Atlantic and Pacific destinations than the U. S. Gulf Coast. The Mediterranean is closer to all European ports than any Western Hemisphere source. Sumatra, Borneo, New Guinea, and even the Persian Gulf are closer supply sources for the western Pacific than the Caribbean or U. S. Gulf Coast.

Notes on the New Deal

On a postal card from Oklahoma, we received the following message referring to an article in WORLD OIL headed "Oil Men Fear Beginning of Bureaucratic Control":

"Cheer up, Mr. Dudley. The New Deal Octopus had long tentacles and spread its slimy idea over our whole industry. If a Republican president is elected this fall you will see the remainder of that blighting crew given the DDT and the U.S.A. will soon be back to normal which means capitalistic enterprise. It will be no thanks to Texas and the Solid South but in spite of them, however."

Referring to the last sentence in the above, it seems to us that either the gentleman from Oklahoma or I misread the papers somewhat during the past sixteen years, because we are under the impression that there were some states in addition to Texas and the Solid South which voted New Deal. May God forgive them all.

R.L.D.

Drilling Contracting Is Big Business Now

THE DRILLING CONTRACTING business is big business. Without fanfare, and possibly without the realization of many individual contractors, the business has steadily increased in volume to where it now amounts to over a half-billion dollars annually, with indications that increased footage to be drilled this year will add substantially to this figure. Operations as a group have increased in recent years from 50 percent of all wells drilled to a total of more than 82 percent.

With drilling contractors becoming of increasing importance to the oil industry, it behooves them to place increased emphasis on such problems as costs, accounting procedures, insurance, educational programs for employees, etc. In the matter of costs, for example, the cost of operating a rig in 1941 averaged about $700 per day. It now costs about $1050 per day to operate the same rig.

Because some contractors have failed to take into consideration fully all factors relating to cost, depreciation, etc., the mortality rate among contractors has been relatively high. The interdependence of the contracting business and the oil industry as a whole makes it essential that margins of profit of drilling contractors should be held as a level commensurate with the work and risks they undertake.

YOU GET 3 Big Service Extras

—when you buy a NEW GM "71" Diesel Engine

Installation Inspection:

The GM Diesel representative inspects and checks the engine without cost to the owner; whenever possible this is done before the engine is put to work. He explains how to successfully operate the engine and the "preventive maintenance" necessary for best results in days to come.

2. *Performance Inspection:*

From thirty to sixty days after the engine has begun its job, another inspection is provided without charge. The GM Diesel representative makes any adjustments that may be required and tunes up the engine to its best performance.

3. *Owner's Service Policy:*

Besides the above inspections, GM Diesel owners are protected by an exceptional warranty outlined in the owner's service policy.

WE WANT every purchaser or prospective purchaser of one of our engines to know how his local distributor and dealer, with their factory-trained servicemen, stand back of the product. They in turn are backed by the knowledge that Detroit Diesel supports them strongly in their adherence to this policy.

GM GENERAL MOTORS DIESEL POWER

DETROIT DIESEL ENGINE DIVISION

SINGLE ENGINES.. *Up to 200 H.P.* **DETROIT 28, MICHIGAN** MULTIPLE UNITS.. *Up to 800 H.P.*

GENERAL MOTORS

HELP AMERICA PRODUCE FOR PEACE — Turn in SCRAP Iron and Steel

DIESEL BRAWN WITHOUT THE BULK

GENERAL MOTORS CORP., DIESEL ENGINE SALES, PETROLEUM INDUSTRY, 1504 Philtower Bldg., TULSA 3, OKLAHOMA

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Power Equipment, Inc. WICHITA, KANSAS
George Engine Co. NEW ORLEANS 18, LA.
United Tool & Valve Repair Co. SHREVEPORT, LOUISIANA
Western Machinery & Engine Co. ST. LOUIS 10, MISSOURI
Seitz Machinery Company, Inc. BILLINGS, MONTANA
Diesel Power Co. OKLAHOMA CITY, OKLAHOMA
Stewart & Stevenson Services, Inc. HOUSTON 11, TEXAS
Empire Oil Field Machinery Co. ODESSA, TEXAS
Gehring Equipment Co. CASPER, WYOMING

Court Upholds WORLD OIL

Federal Judge Rules Magazine Has Full Right to Use of Name

THE right of the publication, WORLD OIL, to the use of that name was confirmed in Federal Court in the Southern District of California at Los Angeles in July, when U. S. District Judge Leon R. Yankwich handed down an opinion in a suit filed by the owner of *World Petroleum* against the Gulf Publishing Company, owner of WORLD OIL. The plaintiff had asked for an injunction against the use of the name "World Oil."

The decision was a complete victory for the Gulf Publishing Company, the judge ruling that the plaintiff had no exclusive right to the use of the word "World" in its name, because it was a descriptive name. He further held that the Gulf Publishing Company had in no wise attempted to mislead its subscribers and advertisers into thinking that WORLD OIL and *World Petroleum* were one and the same publication.

After reviewing the dissimilarity in format, color scheme on cover, symbols, etc., the judge said:

"So, the format, the type used, the color scheme, the setup of the cover and of the front page (or table of contents), the decorative emblems used, are as unlike as they could be made. *They are all designed not to create, but to avoid confusion.* If, to this, we add the fact that the defendant carries above the masthead of WORLD OIL the legend 'Established in 1916 as *The Oil Weekly*' and that the words 'The Oil Weekly' are in white type, smaller but of the same kind as the main title, and are directly above the word 'World' so that anyone looking at the title would immediately see it in combination with those words, we have a case in which the latecomer is shown to have taken every conceivable precaution to avoid confusion with any similar publication which preceded it in the field. Such precautions do not spell a desire to create confusion, but a meticulous determination to resort to the most punctilious means to avoid it. Add the following facts: The publications are not sold to the general public, but are circulated among the members of a specialized group. *World Petroleum* is sent gratis to executive personnel in the oil industry. WORLD OIL, although sold to subscribers, reaches an equally limited field of oil industry executives."

Continuing, the judge said:

"Advertisements are secured through advertising agencies. In the light of these facts, it would require an unjustifiable stretch of imagination to hold that—absent any legally recognizable rights—the plaintiff has the exclusive right to the use of the word 'World' in conjunction with any word synonymous with 'petroleum,' or that such use would have a tendency to mislead."

No Confusion Shown

Referring to the incidents which the plaintiff had introduced as evidences of confusion, the judge dismissed them as trivial with these words:

"However, the plaintiff has offered some incidents which it is claimed show confusive results. Reduced to their essence, they consist of undelivered letters, misdirected telephone calls, and telephone calls to persons connected with one rather than the other of the publications. These are of small significance, and entitled to little weight. They are the type which, as Mr. Justice Brewer stated on one occasion, are traceable to

"'*careless*' or to persons '*not particularly attentive,*' and which '*will happen in the ordinary course of business, no matter how great the differences.*' (Emphasis added.)

"As said by the present Chief Justice of the United States, when he was Associate Justice of the United States Courts of Appeals for the District of Columbia:

'*A publisher though he has a registered trademark cannot be protected from all of the inadequacies of human thought and memory. * * * Probably confusion cannot be shown by pointing out that at some time, some one made a false identification.* The plaintiff did not show one instance of a newsstand purchaser receiving the magazine he did not intend to buy. Under both methods of determination, we conclude, without hesitation, that the defendant's title does not infringe the plaintiff's registered trademark.' (Emphasis added.)

"More, we have the fact that Rex Wadman, the general manager of the plaintiff's publications, stated emphatically at the trial that he knew of no instance of anyone's subscribing to the defendant's magazine or sending for it in the belief that it was the plaintiff's, or of any agency or person concluding an advertising contract or placing a single advertisement with the defendant's publication in the belief that it was that of the plaintiff.

"So we have no diversion of advertising patronage. Indeed, none such is likely to occur because many advertisers in the oil business, advisedly and with full knowledge of facts, use both publications as media. On the whole, there cannot be, under the circumstances existing in this case, the confusion of source which the law of trademarks or the law of unfair competition condemns."

Evidence was offered as to the comparative standings of the two publications from a business and circulation standpoint, and because of the superior rating of WORLD OIL, its attorneys pointed out that WORLD OIL, and not *World Petroleum* would have suffered if any confusion had arisen. Evidence had been offered by the defendant and accepted by the plaintiff that WORLD OIL published annually two and one-half to three times more advertising volume than *World Petroleum* and that WORLD OIL had more paid subscribers by approximately 100 percent than *World Petroleum* had free distribution copies. (Evidence had also been presented showing that WORLD OIL was devoted to the production-pipe line branches of the oil industry and that the free copies of *World Petroleum* went to men in the refining as well as the production-pipe line branches.)

In his testimony on the stand, Ray L. Dudley, publisher of WORLD OIL, testified that his publication had been actively covering world oil affairs, had been engaged in developing circulation among oil men abroad, and had sent an editor into almost every oil field of the world outside the U. S. several years before *World Petroleum* was founded. He said that plans to change *The Oil Weekly* to a monthly publication and the constantly increasing importance of oil operations outside the U. S. with a consequent broadening of the effect of foreign operations on domestic oil affairs, and vice versa, were the reasons for

■ CONTINUED ON PAGE 38

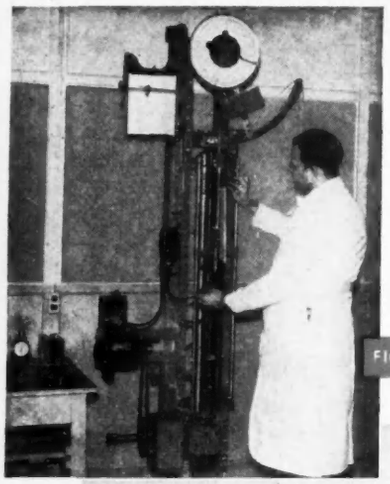

FIG. 1

We can't bring our Lab to you . . .

but THE NEXT BEST THING is to show you pictures of how our laboratory tests each batch of rubber that will be molded into Patterson-Ballagh Casing Protectors, Stabilizers, Pipe Wipers, and other Oil Field Specialties. Here are a few of the many tests performed to give you better rubber and more value for your money.

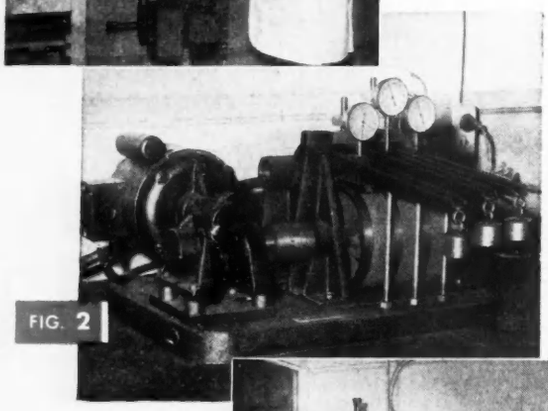

FIG. 2

FIG. 1 A sample of rubber, molded and cut to one thousandth of an inch tolerance, is stretched on this special tensile testing machine. The amount of stretch, ultimate tensile strength, modulus, and tear resistance are determined to insure that the rubber has the strength to do the job for which it is intended.

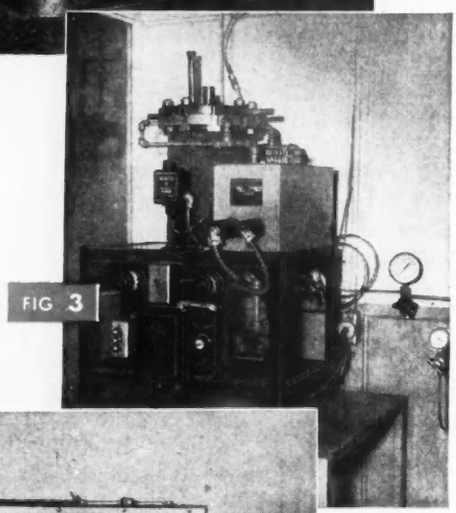

FIG. 3

FIG. 2 We know that Patterson-Ballagh rubber is going to give you long service, even under abrasive conditions. Rubber samples are placed in this abrasion testing machine to determine abrasion resistance. Each batch of rubber must conform to standards set by 21 years' experience in the manufacture of Casing Protectors.

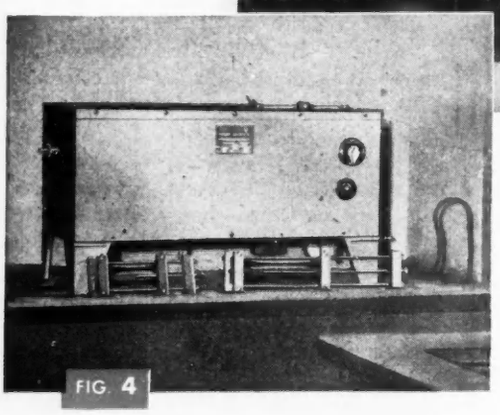

FIG. 4

FIG. 3 In this oxygen pressure aging equipment, the equivalent of several years' aging is completed in several hours. Rubber samples are also subjected to a high temperature over specified periods. The samples are tested and inspected for changes in physical properties. Patterson-Ballagh Oil Field Specialties keep their elasticity and other properties when in stock or not in use in the field.

FIG. 4 Simulating actual operating conditions, this oil bath determines the resistance of rubber to hot oil. The rubber samples are immersed in the bath under various conditions and then subjected to exhaustive tests. Tests such as the above make Patterson-Ballagh the leader in the manufacture of oil-resistant rubber for Oil Field Specialties.

Correct formulation and processing—regulated by rigid testing and inspection—provide operators the world over with *proven* Patterson-Ballagh Oil Field Specialties.

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MONTHLY NEWS ANALYSIS

NO OVER-ALL OIL SHORTAGE EXPECTED . . . OFFSET WELLS MUST BE DRILLED
CONSERVATION LAW REVISED . . . MIDWEST PIPE LINE CAPACITY EXTENDED
NEW CENSUS PROGRAM ENACTED . . . PROFITS EXPECTED TO RISE IN 1948

Present Supplies Indicate No Over-all Oil Shortage Due

A cheerful view of the oil supply outlook was expressed by Howard Page, executive assistant to the president of Standard Oil Company (N. J.) in testifying before the oil subcommittee of the House commerce committee, headed by Representative Wolverton.

"Our estimates indicate," said Page, "that there will not be any over-all shortage during the coming year, barring war, disaster, or serious strikes. We don't think, however, that all instances of localized spot shortages can be avoided."

Page said an annual supply capacity will have to exceed annual average demand by 200,000 to 300,000 barrels a day before spot shortages are again as few as they were before the war. He asked the question, "Will adequate oil supplies be assured without the use of more steel than present plans call for?" and answered it as follows:

"Yes, if the steel already scheduled for delivery to the industry is actually received. The reasons are:

"1. Actual domestic refinery runs on a sustained basis have exceeded the maximum rate which will be required to process all the crude that will be available during the coming year. These runs, amounting to 5,670,000 barrels daily, have been achieved without fully utilizing all the strategically situated refining capacity.

"2. Stocks of refined products are approximately 32 million barrels more than they were a year ago.

"3. There are enough tankers and new tanker construction is proceeding at a rate which should be able to take care of increases in supplies during the coming year.

"4. Internal transportation appears to be satisfactory. One major crude pipe line into the Midwest has just been placed in operation. Others are scheduled to be completed soon.

"Domestic crude production at the present time is approximately 225,000 barrels daily higher than it was nine months ago. This rate of increase is appreciably greater than would be required during the next nine months to meet minimum production levels which the Economics Committee of the Oil Compact Commission estimated would be needed to satisfy demands.

"6. Foreign crude production also has been stepped up sharply in the last nine months. Near and Middle East output is now about 1,020,000 barrels daily, an increase of 150,000 barrels a day in the last nine months. Production in Venezuela now is about 1,340,000 barrels daily, an increase of 100,000 barrels a day in the last nine months."

Union at Cleveland Refinery Rejects Settlement Offer

It has been hoped that U. S. refinery runs would not be reduced this year through strikes as maximum runs are essential. However, a setback of these hopes occurred in early July when the C.I.O. oil workers' union called a strike at the two refineries and can factory of Standard Oil Company (Ohio) at Cleveland.

The union rejected offers of the company for "third round" wage increases of 12½ to 17½ cents an hour, having demanded raises of 26 cents an hour for refinery workers and 98 cents an hour for can factory employees. The company said its proposals would have made its plants among the highest paid oil refineries in the world. It said its offers compared with other settlements in the oil industry of 12 to 18 cents per hour and with settlements in other major industries of 10 to 14 cents.

The company stated it was making no effort to operate its Cleveland refineries following the calling of the strike. It expressed hope that an agreement could be worked out with employees' representatives in the early future. It said stocks on hand were sufficient to meet normal demand for some time, though a long strike would make supply uncertain.

The strike involved 950 Sohio employees at Cleveland, 575 in a gasoline refinery, 250 in the lubricating oil plant, and 125 in the can factory. The company is reported to have crude oil charging capacity of about 37,000 barrels daily at Cleveland. It said that it recently signed contracts with A. F. of L. unions for Sohio employees at the company's two other gasoline refineries at Lima, Ohio, and Latonia, Ky., calling for substantially the same terms as were offered to the C.I.O. union at Cleveland.

Court Holds Operators Must Drill Offset Wells

An operator's responsibility and obligation in the matter of offset wells was clearly defined recently in a federal decision at Oklahoma City which may have far reaching effects on this question. In a civil action brought against a major oil company the federal bench ruled that said company should have started an offset well within 90 days after the completion of a well which patently was draining the oil from plaintiffs' land, or given up the lease.

Attorneys and oil men are debating the effects of the decision. In its ruling the court declared that "an oil company in determining whether it is going to drill a well has to deal 'at arm's length' with the royalty owner because it is deciding a matter affecting both parties, and it has to be very careful in making its decision." Attorneys for the plaintiffs declared the ruling was of far reaching significance and said: "The court may hold that in a common source of supply, where lines are erased, the edge leases must be evaluated even though not drilled so as to protect the correlative rights of all the owners of the reservoir, no matter whether the wells were drilled and producing on the tract or not."

In effect, according to some interpretations, lease owners either must drill offsets within 90 days, indeminfy the land and royalty owners for land which is being drained by offset wells, or give up the lease. The case is sure to reach the Supreme Court, especially in these days when scarity of tubular goods may make it possible to fulfill a drilling obligation.

Oil and Gas Conservation Model Law Being Revised

State legislatures convening in 1949 will have for their consideration a revised and improved model law for oil and gas conservation, as offered by the Interstate Oil Compact Commission. The present model law of the organization is being rewritten by a subcommittee of the legal committee.

The subcommittee initiated work on the new law in a recent meeting in Santa Fe, N. M. It was concerned primarily with drafting of proposals relating to agreements authorizing unit operations, statutory authorizations for orders providing for unitization, well spacing and the pooling for drilling of a well or wells in a drilling unit, and production control and the allocation of production. Members of the subcommittee include T. Murray Robinson, Oklahoma City attorney, chairman; Robert E. Hardwicke, oil law authority, Fort Worth, Texas; Ross T. Malone, Jr., Santa Fe; E. Leland Richardson, Baton Rouge, La.; and Blakely M. Murphy, executive secretary of the subcommittee, Knoxville, Tenn.

Numerous sections are being added to the previously published law. The subcommittee also is seeking to simplify the language in all sections retained, supply tag lines for all sections, and prepare an index. The alternate sections are being eliminated from the bill and relegated to footnotes or an appendix.

Suggestions made by the Compact Commission have been widely circulated, and the laws of several states have been modeled on the provisions contained in the reports.

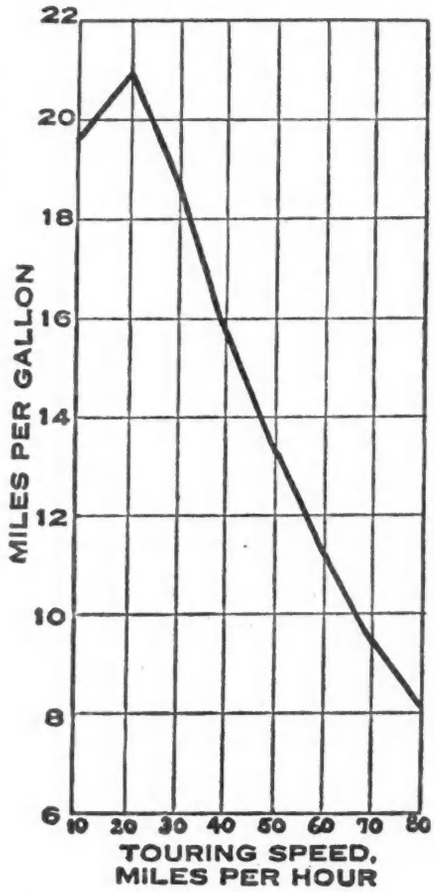
This rewriting of the model oil and gas conservation law comes in response to increasing realization that many existing state laws are in need of modernization and improvement. The laws should be amended, it is asserted, so as to make permissible or mandatory various improved oil and gas development techniques and practices, which will provide increased recovery from oil and gas reservoirs. It has been suggested in some quarters, for example, that unitization and pooling of leases for development are so desirable that it should be possible for the states to make them mandatory under certain conditions.

Moderate Driving Speeds Asked to Save Gasoline

The faster you drive, the less mileage you obtain per gallon of gasoline, the more gasoline you use, and the more you aggravate the scarcity of gasoline, warns the American Automobile Association.

The automobile manufacturers' organization, like the petroleum industry, wishes to prevent gasoline shortages. Therefore it is cooperating with the petroleum industry in efforts to induce the public to use petroleum products conservatively, so as to avoid shortages and save money as well.

The association is publicizing, for example, the undesirable effect of high driving speeds on gasoline consumption. Moderate speeds and resultant lower consumption of gasoline are especially important now, it is stated, in order to avoid gasoline shortage.



By means of the graph here reproduced, the association shows that as the speed of an automobile is increased, the mileage obtained per gallon of gasoline comes down sharply, thus greatly increasing the consumption of gasoline. The chart is based on figures compiled by the U. S. Bureau of Standards.

Average automotive speed on main rural highways was 46.8 miles per hour in 1947, almost back up to the prewar 47.1 miles, according to the Federal Public Roads Administration. Average truck speed on rural highways was up to 42.2 miles per hour from 40.4 before the war, reflecting increased numbers of new and faster trucks.

Added Crude Pipe Line Capacity for Midwest

Dedication of the 650-mile 20-inch trunk line completed by Magnolia Pipe Line Company between Corsicana, Texas, and Patoka, Ill., gives the Midwest area another source of crude and augments existing facilities. The new line, with a daily throughput of 108,000 barrels of crude, replaces a system which began as a single eight-inch line traversing much the same territory.

The new line incorporates the newest types of power and pumping equipment and is provided with automatic safeguards at all points. It should assure the Midwest area its capacity in uninterrupted deliveries and enable the area better to meet demands through providing refineries in the area with stocks which will most effectively be worked up into the fuels and oils required.

Manufacture of Steam Locomotives Ended

A crucial point has been reached in the hitherto accelerating trend away from steam locomotives to diesel-electrics, forecasting further increases in use of diesel oil by the railroads. On a June day the American Locomotive Company plant at Schenectady, New York, ceased to make steam locomotives and the last one it had manufactured chugged away, bound for Cleveland. All hands then turned to diesel-electric production.

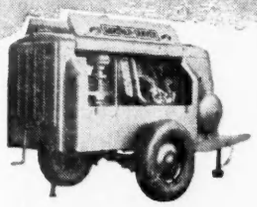
New Census Legislation Passed by Congress

A new program of census taking by the federal government will be carried out in the future under legislation passed in the recent session of Congress. Manufacturers will be surveyed every five years instead of every two years as in the past. Non-manufacturing companies will be surveyed every five years, also, instead of every ten years.

The census of manufacturers and the census of business (wholesale, retail, and service trades) and mineral industries in the future will be taken together in years ending in 3 and 8, and at these times there will also be a new census of transportation. This program will be launched early in 1949 when the census of business for 1948 will be taken, with enumerators calling on 3 to 4 million non-manufacturing firms. Manufacturers will be exempted from this survey for 1948 since they are covered for 1947 under the old program. But beginning in 1953 and every five years thereafter, all the business surveys will be taken together.

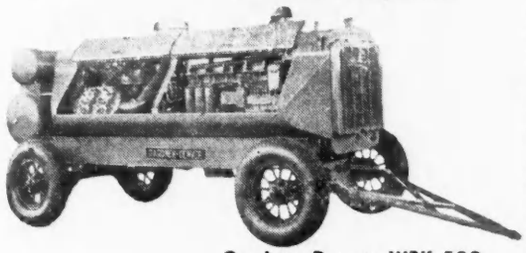
Every ten years, ending in 0, as heretofore, the Bureau of Census will cover population, employment, income, and probably housing. Every five years, ending in 3 and 8, there will be a census of manufacturers, trade, minerals, and transportation. Every five years, ending in 4 and 9, there will be a census of agriculture. Every ten years, ending in 2, there will be a census of religious bodies.

HERE'S THE *Quality* LINE



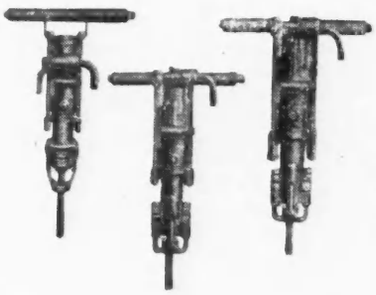
Gardner-Denver WHD-105
Portable Compressor

Gardner-Denver WHF-210
Portable Compressor



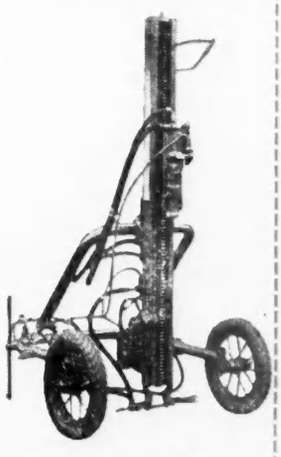
Gardner-Denver WBK-500
Portable Compressor

You're *sure* of an adequate and continuous supply of air when you specify Gardner-Denver Portable Two-stage Water-cooled Air Compressors. *Completely* "water-jacketed" for protection against overheating . . . cold "unlubricated" starts . . . high lubricating oil consumption, Gardner-Denver Portables give you the air you need in any climate or at any altitude. For further information about the complete line of Two-stage Water-cooled Air Compressors, ask for a demonstration or write Gardner-Denver Company, Quincy, Illinois.



No matter what the type of ground, there's a Gardner-Denver Sinker that is "right." Shown from left to right are the S33, the S45 and the S55—part of a complete line of Sinkers available for every need.

T23 Tamper. Balanced for smooth handling, this tamper easily walks over the fill. The plated and polished piston is easy on the front head packing — eliminates loss of power from air leakage. Integral oil reservoir assures complete lubrication.



URM99 Wagon Drill. The *new*, faster drilling motor feed wagon drill. Designed for quicker, 6-foot steel changes; carries a 3½" to 4" bore derrick drill. 5-cylinder radial air motor operates motor feed.

B87 Paving Breaker has an exclusive safety latch that works like the "safety" on a gun—prevents accidents before they start. Operator can move breaker safely from place to place without shutting off air.

GARDNER-DENVER
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Trans-Arabian Releases Pipe for Domestic Use

Some unexpected alleviation of the shortage of natural gas for the Appalachian region is promised as a result of a new development affecting the Trans-Arabian pipe line. The Trans-Arabian Pipe Line Company in early July released 64,000 tons or 255 miles of 30 and 31-inch pipe to Tennessee Gas Transmission Company on a trade-out basis. T. G. T. will repay Trans-Arabian from its deliveries scheduled later this year.

The large pipe will be used by T. G. T. in Texas and Louisiana on its project of looping its line to the East, which is about 75 percent complete. The 255-mile loop is expected to be completed before the end of this year. Actual laying of pipe will begin in August. The pipe, loaded on ships at Long Beach, Calif. will go via Panama Canal to Houston and Beaumont, Texas. With benefit of the loop, the gas line will step up its throughput by 200 million cubic feet daily, to a total of 600 million, an increase said to be equivalent to 33,000 barrels per day of fuel oil. The Eastern fuel situation thereby will be materially relieved this winter.

The pipe was released by Trans-Arabian because the Department of Commerce has delayed licenses for exporting it to the Middle East. It was stated, however, that the company intended to proceed with construction of the line across Arabia as soon as conditions would permit. The Department of Commerce, having refused export licenses on the pipe that was later released to the gas company, has announced that decision would be reached early in September on further shipments this year.

50 Percent Increase In Profits Forecast

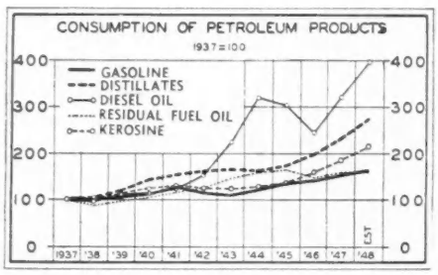
Oil industry profits for the year 1948 probably will be about 50 percent larger than for 1947, Standard and Poor's Corporation forecasts in a current analysis of the industry. This estimate takes into account the continuing increases in demand for petroleum products and the higher prices received in 1948 for crude oil and products.

In the first quarter of 1948 oil companies showed sharply higher earnings than in the initial quarter of 1947. But the rate of gain over 1947 will be less as the year progresses, since 1947 brought gradual improvement of earnings, with prices advancing and volumes of business increasing in the closing quarters of the year.

Integrated companies are expected to show noteworthy increases in earnings. They will benefit from the present relatively high prices for crude oil and also from the present wide refinery margins.

Because of heavy capital expenditures made in necessary expansion of facilities, oil companies will continue to pursue conservative policies in paying dividends to stockholders. However, payments for 1948 may be about 25 percent greater than in 1947, according to the analysis.

In explaining the current favorable earnings in the oil industry, the Standard and Poor's analysis commented on the continuing strong demand for petroleum products and presented a chart showing trends for principal products, which is herewith reproduced. Reflecting increased dieselization of the railroads, consumption of diesel oil shows the largest percentage gain of any product.



Given steel to complete its extensive expansion program and a chance to increase imports, the industry will be able to bring supply and demand more nearly into balance, states the report. In view of the increasing number of installations requiring oil as a primary fuel, it added, the continuation of the growth trend appears assured for several years.

Subcommittee Urges Continued Conservation

Continued oil conservation by the consuming public and increased efforts by the industry to make more supplies available were urged by a subcommittee of the Senate commerce committee in Washington in early July. Headed by Senator Clyde M. Reed, Republican, Kansas, the subcommittee warned that New England and the North Central states, particularly, will be confronted with tight supplies of gasoline later this summer and of kerosine and heating oils during the coming winter. Kerosine stocks were described as seriously below requirements. The subcommittee will continue to watch the situation and hold another meeting about October 1.

The group urged governors of 32 states to reactivate emergency fuel coordination activities. It urged the other 16 governors to appoint emergency fuel coordinators to handle conservation and distribution programs like those used last winter. The subcommittee also asked the governors to study reductions in speed limits, declaring that gasoline consumption of an automobile at 60 miles per hour is nearly twice that at 40.

"In view of the fact that prices of petroleum products have risen sharply," stated the subcommittee, the petroleum industry is advised to "give earnest consideration to the hope of the committee that further price increases be avoided, so that any federal action looking toward price controls or compulsory allocations may be avoided." The group reported that many state fuel coordinators and consumers had protested petroleum price increases and that some had urged price controls and compulsory allocations.

Home Fuel Storage Urged To Avoid Winter Shortages

Appreciable improvement of fuel oil supply for domestic consumers in the East and Middle West is expected for next winter as a result of increases in storage capacity of individual homes. The oil industry has been urging increase of home storage capacity, and many householders have been complying with the advice, remembering the scarcity of supply last winter.

New York City has now amended restrictions to permit householders to install two ordinary 275-gallon basement tanks instead of one in a single home, and the National Fire Protection Association and the insurance underwriters agreed to the change. There are not and have not been heretofore any restrictions on the number of fireproof tanks that can be used.

Court Upholds World Oil

■ CONTINUED FROM PAGE 33

the change of name of *The Oil Weekly* to WORLD OIL.

Technical evidence on how an advertising agency operates in making up schedules was presented by M. L. Gowans, The Darwin Clark Advertising Agency, and Kinzie Miller, identified as one of the owners of *California Oil World*, testified that his publication had used the word "World" in its name for more than 40 years, or many years prior to the founding of *World Petroleum*.

Witnesses put on the stand by Gulf Publishing Company were M. L. Gowans, Kinzie Miller, and Ray L. Dudley. Witnesses put on the stand by the plaintiff were the general manager of *World Petroleum* and a partner of the owner of *World Petroleum* in another publishing enterprise.

Attorneys for the plaintiff were Kenneth E. Grant and Richard A. Perkins, Los Angeles.

Attorneys for Gulf Publishing Company were Leon Jaworski of Fulbright, Crooker, Freeman and Bates of Houston, and Ward D. Foster of Harris, Kiech, Foster and Harris, Los Angeles.

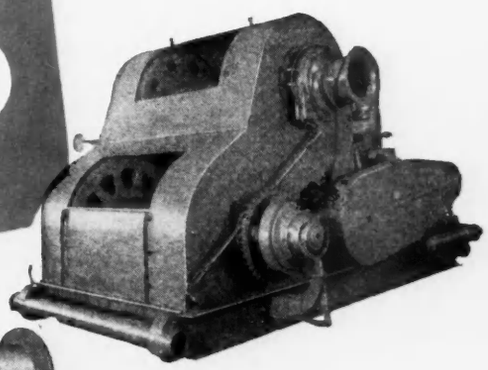
Number of the case was 7614-Y.

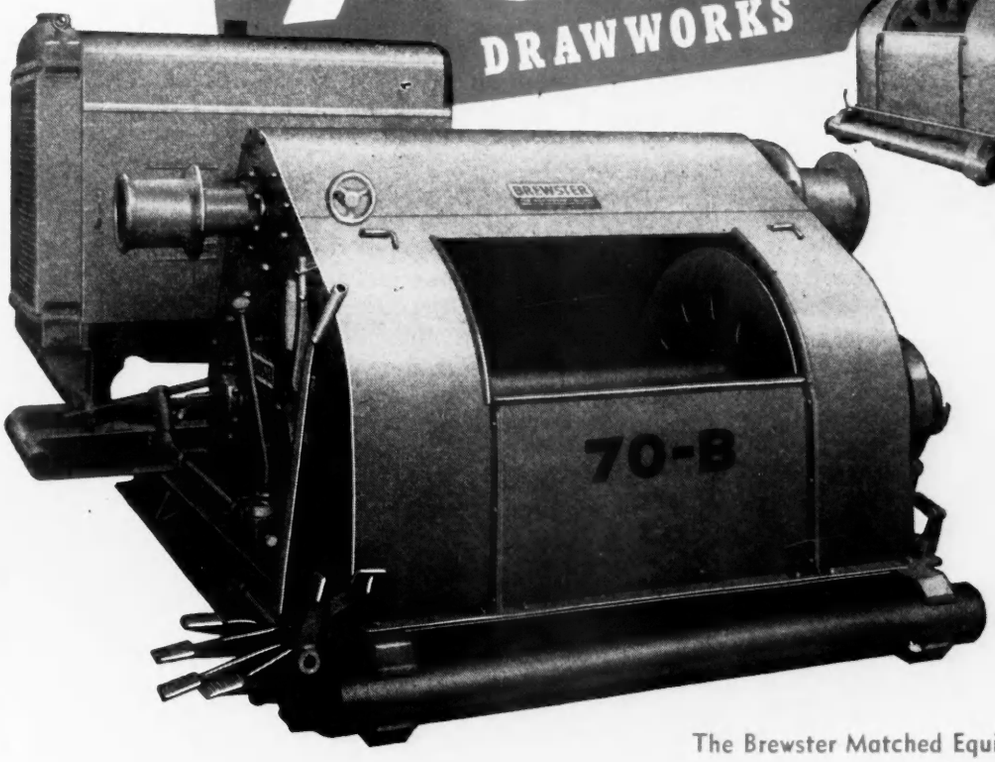
FAVORITES....

FOR DRILLING TO 3500'
FOR SERVICING TO 7000'

The 70-B features friction clutches throughout for easy flexible control. Recommended for use with 145 H.P. engine.

BREWSTER 70-B DRAWWORKS





The Brewster 70-B is also available in a double drum model.

The Brewster Matched Equipment shown on the opposite page is recommended for use with the 70-B.

THE BREWSTER CO., INC.

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Drilling Equipment

BREWSTER BUILDS A COMPLETE LINE OF
"Pre-Tested" WELL HEADS, TUBING HEADS, CASING HEADS,
COMPLETE WELL ASSEMBLIES

Looking Ahead

• U. S. DOMESTIC crude oil production continues to increase, despite misgivings about ability to expand output. Production of crude plus natural gasoline and condensate will go above 6 million barrels daily before end of 1948. Output of crude alone will go above 6 million daily in latter part of 1949 or early 1950 if recent trends continue.

• OIL SUPPLY outlook as seen recently by Max W. Ball, director of oil and gas division of Department of Interior: (1) no gasoline shortages this summer except possible brief local shortages; (2) heating oils not quite as tight as last winter; (3) kerosine a possible trouble spot requiring special precautions; (4) residual fuel oil probably adequate if coal or railroad strikes do not force industries back to fuel oil; (5) natural gas critically short in northeastern Middle West, involving periodic shutdowns of industrial plants for lack of fuel.

• A 50-TON per day pilot plant for shale retorting is being constructed by a large West Coast oil company. The company estimates that the new plant, based upon a smaller plant that has been in operation for some time, is expected to provide the most economical means yet devised for the extraction of oil from shale. The smaller plant, of unique but simple design, recovered from 30 to 70 gallons of oil per ton of Colorado shale. In addition, the process produces more than enough gas to provide heat and power for the recovery process.

• U. S. WILL HAVE available sufficient tankers to meet requirements at least for the next year, estimated the National Petroleum Council.

• CALIFORNIA may gain some petroleum production as a result of the fact that sprawling Los Angeles has promulgated regulations permitting drilling and production within the city. Rules minimize noise and require park-like appearance of development scenes. A deep wildcat now is drilling within the city.

• PETROLEUM SCARCITY is among economic handicaps now ascribed to Russia to encourage new, tougher attitude by U. S. toward Moscow, some reports indicate. Russian war potential also is believed limited by transportation shortage, unrepaired German damage, and difficulty that would be met in keeping air force repaired and fueled.

• TOTAL EXPORTS of petroleum-industry steel goods will increase, in spite of delays in shipments to Middle East, reports from Washington indicate. More than offsetting cuts in Middle East shipments are increases in shipments to Latin American countries, particularly Venezuela. Protests by domestic producers are a damper on movement but will not prevent increased shipments, it is predicted.

• NATIONAL POLICY of the U. S. with regard to petroleum will be studied by a recently appointed committee of the National Petroleum Council. The group, headed by A. Jacobsen, Amerada Petroleum Corporation president, will restudy and supplement findings of the Petroleum Industry War Council, expressing industry views but now several years old.

• AN OPTICAL comparator, checking grain sizes on a glass screen, is expected to offer new data on the composition of steels and other alloys which have fractured under alternating or excessive stresses.

Five States Yield 84 Percent of U. S. Production

OF THE 48 states of the U. S. 24 or exactly one-half currently produce crude oil, while several others, including Tennessee and Utah, have had small production. However, 84 percent of the nation's current production comes from five states: Texas, California, Louisiana, Oklahoma, and Kansas. By adding the next five largest producing states, it is found that the ten leading states account for 95.8 percent of U. S. production. These five of the second group include Illinois, Wyoming, New Mexico, Mississippi, and Arkansas. The remaining 14 producing states account for only 4.2 percent of the nation's output.

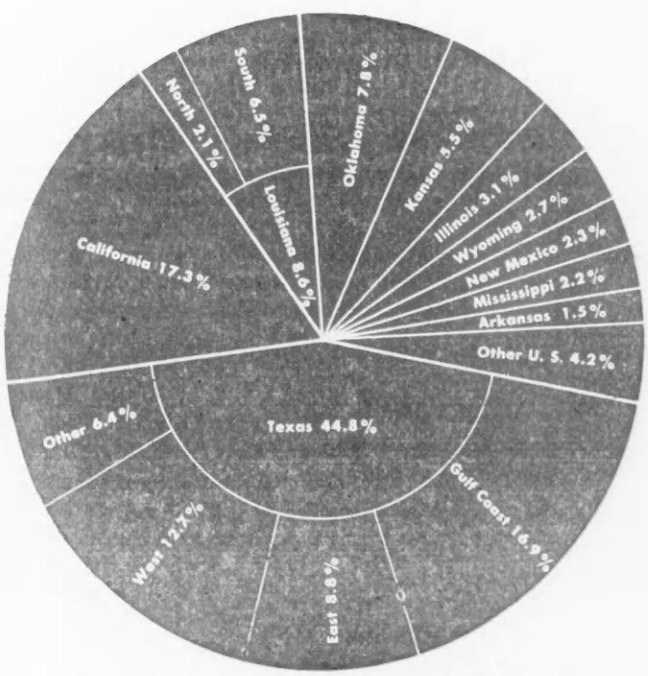
Contributing much more greatly to the national oil production than any other state is Texas, which in June of this year accounted for 44.8 percent of the U. S. daily average output. The state averaged 2,455,300 barrels daily, compared with the U. S. output of 5,485,900 per day. The Texas production came from all sections of the state, but especially large volumes came from West Texas, the Gulf Coast, and East Texas. West Texas alone produced more crude than any state outside Texas except California. Texas has gained its predominant position partly as a result of the urgent need for oil during and since the war. In June of 1941 Texas accounted for only 36.5 percent of the U. S. production, averaging 1,397,600 barrels daily out of a national total of 3,828,500 barrels per day.

California ranks second among the producing states and its current output of over 950,000 barrels daily is 17.3 percent of the national total. This is a slightly higher percentage than prewar, output having been expanded in line with the national increase in production. In June of 1941 the state averaged 638,900 barrels daily.

Louisiana also has increased its production in line with the gain for the nation. Current production of 469,200 barrels daily is 8.6 percent of the U. S. In 1941 Louisiana's 321,000 daily was 8.4 percent of the national total. Louisiana has attained third place among the producing states by default on the part of Oklahoma and Illinois, which held third and fourth places in June, 1941, with Louisiana then fifth.

Oklahoma has dropped from third to fourth in rank in spite of a slight increase in present production from the prewar rate. This small increase was not, however, in line with increases for some other states and the U. S. as a whole, and Oklahoma currently accounts for only 7.8 percent of U. S. production whereas it accounted for 11.0 percent in 1941.

Kansas has advanced to fifth place among the states in production from sixth in 1941, having expanded output considerably though not fully in line with the national increase.



Percent of U. S. crude production by individual states. (Based on daily average production in June, 1948.)

U. S. Crude Oil Production by States
From U. S. Bureau of Mines, except June, 1948, estimated from A.P.I. weekly reports
(ACTUAL BARRELS)

STATE OR DISTRICT	JUNE, 1941 Barrels Daily	JUNE, 1941 % of U.S.	JUNE, 1947 Barrels Daily	JUNE, 1947 % of U.S.	JUNE, 1948 Barrels Daily	JUNE, 1948 % of U.S.
Alabama	.....	..	1,100	0.02	1,400	0.03
Arkansas	72,100	1.88	80,800	1.59	82,600	1.51
California	638,900	16.69	914,200	17.93	951,200	17.33
Colorado	6,500	0.17	42,100	0.83	47,100	0.86
Florida	.....	.....	1,000	0.02	800	0.01
Illinois	343,400	8.97	178,200	3.49	172,600	3.15
Indiana	21,500	0.56	16,700	0.33	20,000	0.36
Kansas	229,500	5.99	291,600	5.72	303,500	5.53
Kentucky	12,800	0.33	25,100	0.49	24,100	0.44
Louisiana	321,100	8.39	431,500	8.46	469,200	8.55
North Louisiana	66,800	1.75	96,400	1.89	112,900	2.06
South Louisiana	254,300	6.64	335,100	6.57	356,300	6.49
Michigan	38,900	1.02	43,200	0.85	44,300	0.81
Mississippi	28,600	0.75	94,400	1.85	121,600	2.22
Missouri	100	.....	200	.....	100	.....
Montana	20,600	0.54	23,900	0.47	25,300	0.46
Nebraska	4,500	0.12	600	0.01	400	0.01
New Mexico	109,700	2.87	108,300	2.12	128,200	2.34
New York	14,100	0.37	13,300	0.26	14,200	0.26
Ohio	9,900	0.26	8,800	0.17	10,200	0.19
Oklahoma	421,700	11.01	378,800	7.43	426,900	7.78
Pennsylvania	44,800	1.17	35,300	0.69	33,900	0.62
Tennessee	.....	.....	.....	.....	.....	.....
*Texas	1,397,600	36.51	2,283,800	44.79	2,455,300	44.76
Dist. 1—S. Central	20,100	0.53	21,700	0.43	28,600	0.52
Dist. 2— Middle Gulf	67,600	1.78	166,600	3.26	173,700	3.17
Dist. 3—Upper Gulf	251,800	6.61	494,500	9.69	497,600	9.07
Dist. 4—L. Gulf-S.W.	137,200	3.60	247,700	4.85	256,400	4.67
Dist. 5—East Central	18,800	0.49	40,000	0.78	47,000	0.86
Dist. 6—Northeast	416,300	10.93	450,100	8.82	433,900	7.91
Dist. 7-B—N. Central	26,600	0.70	39,500	0.77	48,300	0.88
Dist. 7-C—W. Central	17,500	0.46	39,000	0.76	46,000	0.84
Dist. 8—West	238,000	6.25	560,700	10.98	697,600	12.72
Dist. 9—North	106,210	2.79	141,500	2.77	139,900	2.55
Dist. 10—Panhandle	76,300	2.00	87,700	1.72	86,300	1.57
Utah	.....	.....	.....	.....	.....	.....
Virginia	.....	.....	200	.....	200	.....
West Virginia	9,400	0.25	7,000	0.14	7,400	0.13
Wyoming	82,800	2.16	119,200	2.34	145,400	2.65
Total U.S.	3,828,500	100.00	5,099,300	100.00	5,485,900	100.00

*Texas data by districts for 1941 based on Texas Railroad Commission and 1947 on API, and therefore do not agree exactly with State totals, which are on Bureau of Mines basis.

7.2 percent More *Demand*

By L. J. LOGAN
Associate Editor

Latest Revised Forecast of United States Supply and Demand, All Oils, 1948 by Quarters, and Actual for 1947

Source: U. S. Bureau of Mines' Monthly Petroleum Forecast, July, 1948

(THOUSANDS OF BARRELS)

ITEM	First Quarter 1948	Second Quarter 1948	Third Quarter 1948	Fourth Quarter 1948	1948 Year (Forecast)	1947 Year (Actual)	Percent Change '47-'48
PRODUCTION							
All Oils	522,300	537,000	554,000	555,500	2,168,800	1,988,797	+ 9.1
(Daily Average)	5,740	5,901	6,022	6,038	5,926	5,449	+ 8.8
Crude Oil	486,600	500,500	516,100	517,100	2,020,300	1,856,107	+ 8.8
(Daily Average)	5,347	5,500	5,610	5,621	5,520	5,085	+ 8.6
Other Oils	35,700	36,500	37,900	38,400	148,500	132,690	+11.9
(Daily Average)	393	401	412	417	406	364	+11.5
IMPORTS							
All Oils	43,900	44,300	46,500	48,000	182,000	159,595	+14.0
(Daily Average)	475	487	505	522	497	437	+13.7
Crude Oil	25,500	28,000	30,000	30,000	113,500	97,532	+16.4
(Daily Average)	280	308	326	326	310	267	+16.1
Other Oils	17,700	16,300	16,500	18,000	68,500	62,063	+10.4
(Daily Average)	195	179	179	196	187	170	+10.0
NEW SUPPLY							
All Oils	565,500	581,300	600,500	603,500	2,350,800	2,148,392	+ 9.4
(Daily Average)	6,214	6,388	6,527	6,560	6,423	5,886	+ 9.1
STOCK CHANGE							
All Oils	−9,300	+24,100	+30,500	−10,500	+34,800	−5,041	.....
Daily Average)	−102	+265	+331	−114	+95	−14	.....
Crude Oil	+3,500	−4,300	+200	+2,100	+1,500	+478	.....
(Daily Average)	+38	−47	+2	+23	+4	+1	.....
Other Oils	−12,800	+28,400	+30,300	−12,600	+33,300	−5,519	.....
(Daily Average)	−140	+312	+329	−137	+91	−15	.....
DEMAND							
All Oils, Total Demand	574,800	557,200	570,000	614,000	2,316,000	2,153,433	+ 7.5
(Daily Average)	6,216	6,153	6,196	6,674	6,328	5,900	+ 7.3
Domestic Demand	546,700	518,300	526,000	581,000	2,172,000	1,988,970	+ 9.2
(Daily Average)	6,007	5,698	5,718	6,315	5,934	5,449	+ 8.9
Exports	28,100	38,900	44,000	33,000	144,000	164,463	−12.4
(Daily Average)	309	427	478	359	394	451	−12.9
Crude Oil Exports	8,800	11,900	13,000	10,000	43,000	46,117	− 6.8
(Daily Average)	97	193	141	109	118	127	− 7.1
Refined Oil Exports	19,300	27,700	31,000	23,000	101,000	118,346	−14.7
(Daily Average)	212	304	337	250	276	324	−14.8
Motor Fuel, Total Demand	192,600	241,400	250,000	229,000	913,000	842,352	+ 8.4
(Daily Average)	2,116	2,653	2,717	2,489	2,495	2,308	+ 8.1
Domestic Demand	185,900	230,100	239,000	221,000	876,000	794,807	+10.2
(Daily Average)	2,043	2,529	2,598	2,402	2,394	2,178	+ 9.9
Exports	6,700	11,300	11,000	8,000	37,000	47,545	−22.2
(Daily Average)	73	124	119	87	101	130	−22.3
Residual Fuel, Total Demand	144,100	127,900	124,500	142,000	538,500	529,139	+ 1.8
(Daily Average)	1,584	1,405	1,353	1,544	1,471	1,450	+ 1.4
Domestic Demand	142,200	124,800	121,500	140,000	528,500	518,394	+ 1.9
(Daily Average)	1,563	1,371	1,320	1,522	1,444	1,420	+ 1.7
Exports	1,900	3,100	3,000	2,000	10,000	10,745	− 6.9
(Daily Average)	21	34	33	22	27	30	−10.0
Distillate Fuel, Total Demand	119,500	78,500	71,500	113,000	382,500	328,150	+16.6
(Daily Average)	1,313	863	777	1,228	1,045	899	+16.2
Domestic Demand	114,500	71,500	63,000	108,000	357,000	298,221	+19.7
(Daily Average)	1,258	786	685	1,174	975	817	+19.3
Exports	5,000	7,000	8,500	5,000	25,500	29,929	−14.8
(Daily Average)	55	77	92	54	70	82	−14.6
Kerosine, Total Demand	40,400	21,600	22,500	38,500	123,000	109,771	+12.1
(Daily Average)	444	237	245	409	336	301	+11.6
Domestic Demand	39,700	20,800	20,500	36,500	117,500	102,507	+14.6
(Daily Average)	436	228	223	397	321	281	+14.2
Exports	700	800	2,000	2,000	5,500	7,264	−24.3
(Daily Average)	8	9	22	22	15	20	−25.0
All Other Oils, Total Demand	78,200	87,800	101,500	91,500	359,000	344,021	+ 4.4
(Daily Average)	859	965	1,103	995	981	943	+ 4.0
Domestic Demand	64,400	71,100	82,000	75,500	293,000	275,041	+ 6.5
(Daily Average)	708	781	891	821	801	754	+ 6.2
Exports	13,800	16,700	19,500	16,000	66,000	68,980	− 4.3
(Daily Average)	151	184	212	174	180	189	− 4.8
CRUDE NEEDED							
Runs to Stills	488,850	509,600	520,700	522,550	2,041,700	1,852,246	+10.2
(Daily Average)	5,372	5,600	5,660	5,680	5,578	5,075	+ 9.9
Demand for Domestic Crude	483,900	505,050	516,100	515,200	2,020,250	1,855,599	+ 8.9
(Daily Average)	5,318	5,550	5,610	5,600	5,520	5,084	+ 8.6

IN THE first half of 1948 the petroleum industry of the U. S. proved able to meet more demand for its products than government and industry economists thought possible. It supplied a total demand for all oils in the amount of 1,127,272,000 barrels, an average of 6,194,000 barrels daily, which was 7.2 percent more than the 5,779,000 barrels per day of demand in the initial half of 1947.

For the whole year of 1948 approximately this same increase in total demand now is forecast by the U. S. Bureau of Mines in a second revision of its original estimates. The bureau now estimates for 1948 a total demand for 2316 million barrels of all oils, an average of 6,328,000 barrels daily, which would be 428,000 barrels a day or 7.3 percent more than the 5,900,000 barrels daily of actual demand in 1947. This estimate was embodied in the revised forecast for 1948, published by the agency along with its monthly petroleum forecast for July.

In addition to supplying a 7.2 percent increase in demand in the first half of this year, the industry made a substantial and needed increase in stocks of refined products, adding about 15 million barrels or an average of 86,000 barrels daily. These stocks will help to supply the further increase in demand which is expected for the latter half of the year. Requirements are foreseen as rising to 6,674,000 barrels daily in the fourth quarter of 1948, when fuel oils will have to come from storage to meet seasonal demand.

The building up of stocks in the first half of 1948 was in contrast with results in the initial half of 1947, when stocks were reduced over 10 million barrels or 58,000 barrels daily.

By virtue of the accumulation of inventories in the first half of this year, it will be possible to continue meeting demand over 7 percent higher than last year by only moderately increasing crude oil production and refinery runs in the third and fourth quarters, Bureau of Mines forecast data indicate. In arriving at the estimate that daily average

Met in First Half of 1948

demand for the year as a whole would be 7.3 percent larger than in 1947, the bureau estimated that crude runs to stills would increase from 5,372,000 barrels daily in the first quarter of 1948, to 5,600,000 barrels daily in the second quarter, 5,660,000 daily in the third quarter, and 5,680,000 daily in the fourth quarter, to give an average of 5,578,000 daily for the year as a whole. That would be 503,000 barrels daily or 9.9 percent more than the actual runs of 5,075,000 barrels per day in 1947. Crude oil production was estimated as rising from 5,347,000 barrels daily in the first quarter to 5,500,000 daily in the second quarter, to 5,610,000 daily in the third quarter, and then to 5,621,000 daily in the fourth quarter.

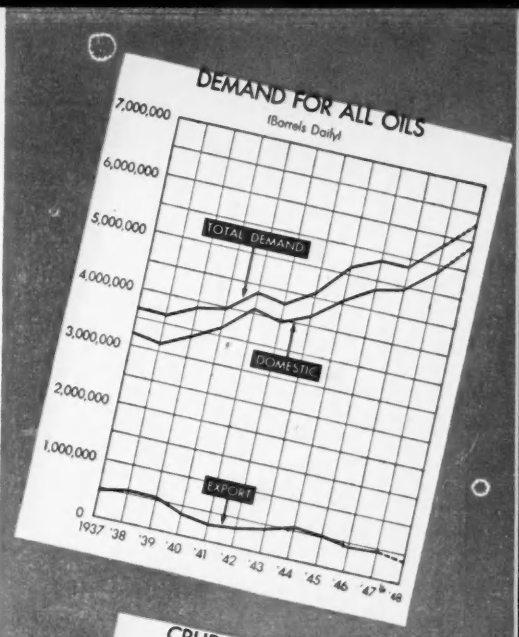
While the industry supplied 7.2 percent more oils per day in the first half of 1948 than in the like period of 1947, it supplied an even larger increase for domestic consumption by virtue of cutting down exports. Domestic demand supplied averaged 5,828,000 barrels daily, an increase of 501,000 barrels daily or 9.4 percent over the 5,327,000 daily of domestic demand in the first half of last year. For the remainder of this year similar results are expected. The Bureau of Mines estimates a daily average domestic demand of 5,934,000 barrels daily, an increase of 485,000 barrels per day or 8.9 percent over the 5,449,000 daily of 1947. Exports averaged 366,000 barrels daily in the first half of 1948, down 86,000 barrels or 19 percent from the 452,000 daily in the like period last year. The Bureau of Mines estimates for 1948 as a whole exports averaging 394,000 barrels daily, down 57,000 daily or 12.9 percent from the 451,000 daily exported in 1947.

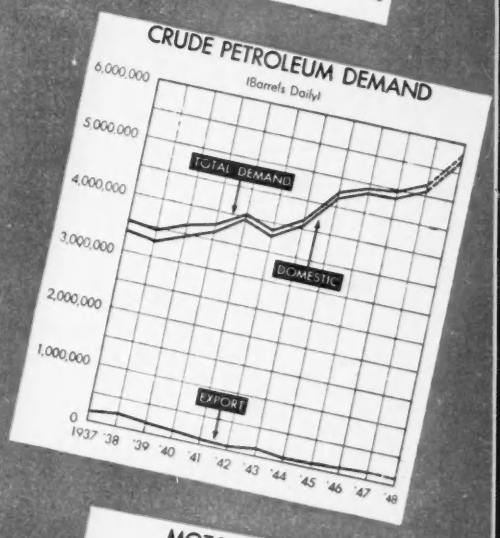
Additions to stocks are expected to continue in relatively large volume in the third quarter, after which seasonal withdrawals will take place in the fourth quarter. For 1948 as a whole a net increase of nearly 35 million barrels or an average of 95,000 barrels daily is forecast. This would contrast with a net reduction of about 5 million barrels or 14,000 barrels daily in 1947. This indicated increase in inventories this year, in the face of meeting sharply higher demand, is a noteworthy achievement.

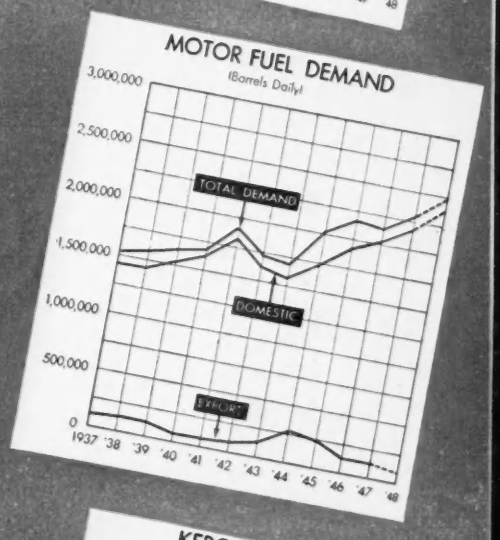
U. S. imports of all oils averaged 481,000 barrels daily in the first half of 1948, an increase of 26,000 barrels daily or 5.7 percent over the 455,000 daily imported in the initial half of 1947. The Bureau of Mines estimates that total imports in 1948 will average 497,000 barrels daily, up 60,000 from the 437,000 daily in 1947. In the third and fourth quarters some stepping up of imports is expected. For the first half of this year the imports of 481,000 barrels daily exceeded exports of 366,000 daily by 115,000 barrels per day. For the whole year 1948 the estimated imports of 497,000 barrels daily would be 103,000 per day more than the anticipated exports of 394,000 daily.

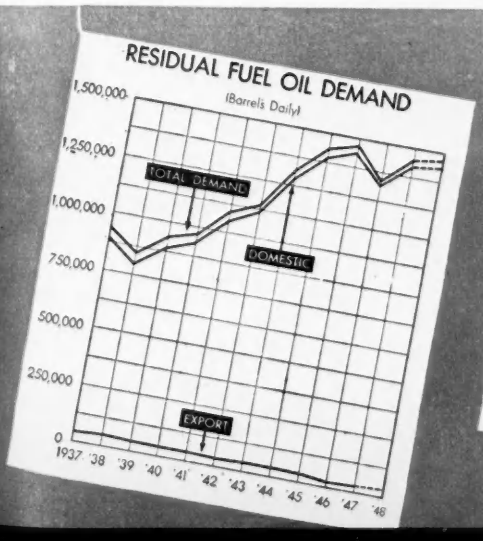
Comparing the first half of 1948 with the initial half of 1947, daily average total demand for principal products showed increases of 8.1 percent for motor fuel, 6.9 percent for kerosine, 17.5 percent for distillate fuel oil, 3.0 percent for residual fuel oil, and about 1 percent for lubricating oil.

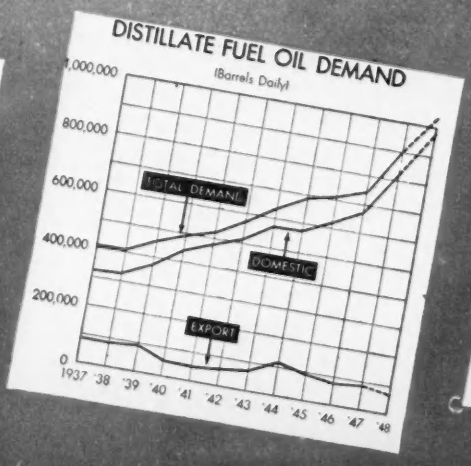
(See table on Page 48)

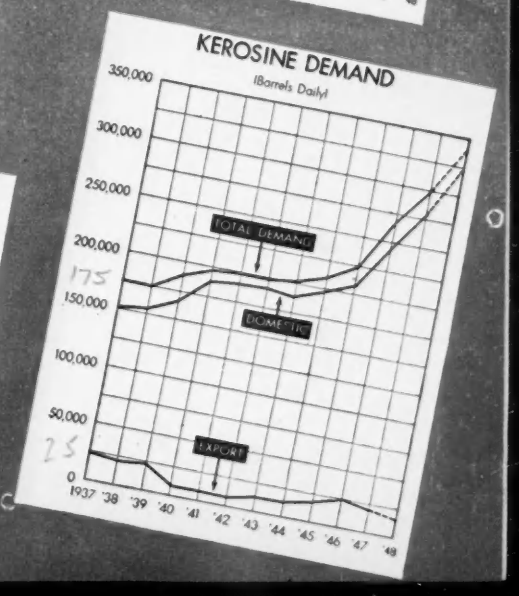












Demand for and Supply of All Oils, Crude Oil, Motor Fuel, Kerosine, Fuel Oil and Lubricants

Sources: U. S. Bureau of Mines except May and June, 1948, estimated with aid of A.P.I. reports

(THOUSANDS OF BARRELS)

ITEM	First Half 1941	First Half 1947	First Half 1948	Percent Difference 1947-1948
ALL OILS				
Domestic Production, Total	705,237	953,211	1,055,414	+ 10.7
(Daily Average)	3,896	5,266	5,799	+ 10.1
Crude Petroleum	666,098	889,883	984,139	+ 10.6
(Daily Average)	3,680	4,916	5,407	+ 10.0
Natural Gasoline	37,403	62,938	71,085	+ 12.9
(Daily Average)	207	348	391	+ 12.4
Benzol	1,736	390	190	— 51.3
(Daily Average)	9	2	1	— 50.0
Imports, Total	43,059	82,276	87,501	+ 6.4
(Daily Average)	238	455	481	+ 5.7
Crude Petroleum	22,014	49,077	53,520	+ 9.1
(Daily Average)	122	271	294	+ 8.5
Refined Products	21,045	33,199	33,981	+ 2.4
(Daily Average)	116	184	187	+ 1.6
Changes in Stocks, All Oils	—11,407	—10,433	+15,643	.....
(Daily Average)	—63	—58	+86	.....
Stocks, Beginning of Period	563,277	507,094	500,800	— 1.2
Refinable Crude	264,709	224,473	224,929	+ 0.2
Heavy Crude in California	11,906	5,703	5,725	+ 0.4
Refined Products	280,958	271,937	265,850	— 2.2
Natural Gas line	5,704	4,981	4,296	— 13.8
Stocks, End of Period	551,870	496,661	516,443	+ 4.0
(Days' Supply)	131	86	83	— 3.5
Refinable Crude	259,695	237,278	223,011	— 6.0
Heavy Crude in California	10,711	5,499	7,686	+ 41.6
Refined Products	275,229	248,502	280,646	+ 12.9
Natural Gasoline	6,235	5,452	5,100	— 6.5
Demand, Total	759,703	1,045,920	1,127,272	+ 7.8
(Daily Average)	4,197	5,779	6,194	+ 7.2
Exports, Total	46,110	81,711	66,679	— 18.4
(Daily Average)	255	452	366	— 19.0
Crude Petroleum, Total	15,896	21,125	19,894	— 5.8
(Daily Average)	88	117	109	— 6.8
Refined Products, Total	30,214	60,586	46,785	— 22.8
(Daily Average)	167	335	257	— 23.3
Domestic Demand, Total	713,593	964,209	1,060,593	+ 10.0
(Daily Average)	3,942	5,327	5,828	+ 9.4
CRUDE PETROLEUM				
Supply:				
Domestic Production, Total	666,098	889,883	984,139	+ 10.6
(Daily Average)	3,680	4,916	5,407	+ 10.0
Imports, Total	22,014	49,077	53,520	+ 9.1
(Daily Average)	122	271	294	+ 8.5
Change in Stocks (incl. Calif. Hvy.)	—6,209	+12,531	+43	.....
(Daily Average)	—34	+69	.....	.....
Stocks, Beginning of Period	276,615	230,176	230,654	+ 0.2
Stocks, End of Period	270,406	242,707	230,697	— 4.9
(Days' Supply)	70	47	40	— 14.9
Supply, Total	694,321	926,429	1,037,616	+ 12.0
(Daily Average)	3,836	5,118	5,701	+ 11.4
Demand:				
Runs to Stills, Total	668,663	880,132	999,173	+ 13.5
(Daily Average)	3,694	4,863	5,490	+ 12.9
Domestic Crude	646,056	831,512	947,699	+ 14.0
(Daily Average)	3,569	4,594	5,207	+ 13.3
Foreign Crude	22,607	48,620	51,474	+ 5.9
(Daily Average)	125	269	283	+ 5.2
Exports, Total	15,896	21,125	19,894	— 5.8
(Daily Average)	88	117	109	— 6.8
Transfers to Fuel Oil Stocks	6,022	15,107	13,000	— 13.9
(Daily Average)	33	83	71	— 14.5
Distillate Fuel Oil	1,220	1,550	1,746	+ 12.6
Residual Fuel Oil	4,802	13,557	11,254	— 17.0
Used as Fuel, and Losses	3,740	10,065	5,549	— 44.9
(Daily Average)	21	55	31	— 43.6
Demand, Total	694,321	926,429	1,037,616	+ 12.0
(Daily Average)	3,836	5,118	5,701	+ 11.4
KEROSINE				
Production, Total	35,901	54,989	62,416	+ 13.5
(Daily Average)	198	304	343	+ 12.8
Percent Yield from Crude	5.4	6.3	6.2	.....
Imports, Total	43	.....	135	.....
(Daily Average)	.....	.....	1	.....
Change in Stocks	+97	—2,428	+884	.....
(Daily Average)	+1	—13	+5	.....
Stocks, Beginning of Period	9,512	17,081	17,722	+ 3.8
Stocks, End of Period	9,609	14,653	18,606	+ 27.0
(Days' Supply)	49	46	55	+ 19.6
Demand, Total	35,847	57,417	61,667	+ 7.4
(Daily Average)	198	317	339	+ 6.9
Exports, Total	802	4,422	1,638	— 63.0
(Daily Average)	4	24	9	— 62.5
Domestic Demand	35,045	52,995	60,029	+ 13.3
(Daily Average)	194	293	330	+ 12.6

ITEM	First Half 1941	First Half 1947	First Half 1948	Percent Difference 1947-1948
MOTOR FUEL				
Production, Total	328,014	394,846	445,702	+ 12.9
(Daily Average)	1,812	2,181	2,449	+ 12.3
Refinery Gasoline, Total	291,968	349,258	395,122	+ 13.1
(Daily Average)	1,613	1,930	2,171	+ 12.5
Percent Yield from Crude	43.7	39.7	39.3	.....
Natural Gasoline, etc.	37,403	62,938	71,385	+ 13.4
(Daily Average)	207	348	392	+ 12.6
Less Sales of L.P.G.	3,093	16,915	20,112	+ 18.9
Less Transfers cycle Prods	.....	825	883	+ 7.0
Benzol	1,736	390	190	— 51.3
Imports, Total	1	101	72	— 28.7
(Daily Average)	.....	1	.....	.....
Change in Stocks	+4,999	—2,903	+13,454	.....
(Daily Average)	+28	—16	+74	.....
Stocks, Beginning of Period	83,647	89,515	87,407	— 2.4
Finished Gasoline	77,943	84,534	83,111	— 1.7
Natural Gasoline	5,704	4,981	4,296	— 13.8
Stocks, End of Period	88,646	86,612	100,861	+ 16.5
(Days' Supply)	50	39	42	+ 7.7
Finished Gasoline	82,411	81,160	95,761	+ 18.0
Natural Gasoline	6,235	5,452	5,100	— 6.5
Demand, Total	323,016	397,850	432,320	+ 8.7
(Daily Average)	1,785	2,198	2,375	+ 8.1
Exports, Total	9,410	24,695	17,950	— 27.3
(Daily Average)	52	136	98	— 27.9
Domestic Demand	313,606	373,155	414,370	+ 11.0
(Daily Average)	1,733	2,062	2,277	+ 10.4
DISTILLATE FUEL OIL				
Production, Total	92,072	143,547	189,659	+ 32.1
(Daily Average)	509	793	1,042	+ 31.4
Percent Yield from Crude	13.8	16.3	18.9	.....
Transfers from Crude	1,220	1,550	1,746	+ 12.6
(Daily Average)	7	9	10	+ 11.1
Imports, Total	1,887	2,180	1,715	— 21.3
(Daily Average)	10	12	9	— 25.0
Change in Stocks	—4,637	—19,944	—4,560	.....
(Daily Average)	—26	—110	—25	.....
Stocks, Beginning of Period	42,911	59,620	51,081	— 14.3
Stocks, End of Period	38,274	39,676	46,521	+ 17.3
(Days' Supply)	69	43	43	.....
Demand, Total	99,816	167,221	197,680	+ 18.2
(Daily Average)	551	924	1,088	+ 17.5
Exports, Total	6,826	13,401	11,900	— 11.2
(Daily Average)	38	74	65	— 12.2
Domestic Demand	92,990	153,820	185,780	+ 20.8
(Daily Average)	514	850	1,021	+ 20.1
RESIDUAL FUEL OIL				
Production, Total	164,125	217,399	236,462	+ 8.8
(Daily Average)	907	1,201	1,299	+ 8.2
Percent Yield from Crude	24.5	24.7	23.6	.....
Transfers from Crude	4,802	13,557	11,254	— 17.0
(Daily Average)	27	75	62	— 17.3
Imports, Total	17,021	29,047	30,408	+ 4.7
(Daily Average)	94	160	167	+ 4.4
Change in Stocks	—8,078	—3,579	+5,379	.....
(Daily Average)	—45	—20	+29	.....
Stocks, Beginning of Period	88,026	47,094	47,091	.....
Stocks, End of Period	79,948	43,515	52,470	+ 20.6
(Days' Supply)	74	30	35	+ 16.7
Demand, Total	194,026	263,582	272,745	+ 3.5
(Daily Average)	1,072	1,456	1,499	+ 3.0
Exports, Total	6,773	5,689	4,914	— 13.6
(Daily Average)	37	31	27	— 12.9
Domestic Demand	187,253	257,893	267,831	+ 3.9
(Daily Average)	1,035	1,425	1,472	+ 3.3
LUBRICATING OILS				
Production, Total	18,333	25,911	26,027	+ 1.1
(Daily Average)	101	143	143	.....
Percent Yield from Crude	2.7	2.9	2.6	.....
Imports, Total	.....	37	.....	—100.0
(Daily Average)	.....	.....	.....	.....
Change in Stocks	—1,414	+717	+499	.....
(Daily Average)	—8	+4	+3	.....
Stocks, Beginning of Period	8,767	7,564	*7,701	*
Stocks, End of Period	7,353	8,281	*8,200	*
(Days' Supply)	67	60	*59	*
Demand, Total	19,747	25,231	25,528	+ 1.2
(Daily Average)	109	139	140	+ 0.7
Exports, Total	4,548	7,628	6,783	— 11.1
(Daily Average)	25	42	37	— 11.9
Domestic Demand	15,199	17,603	18,745	+ 6.5
(Daily Average)	84	97	103	+ 6.2

* 1948 Lubricant stocks on new basis excluding distributors' stocks in California.

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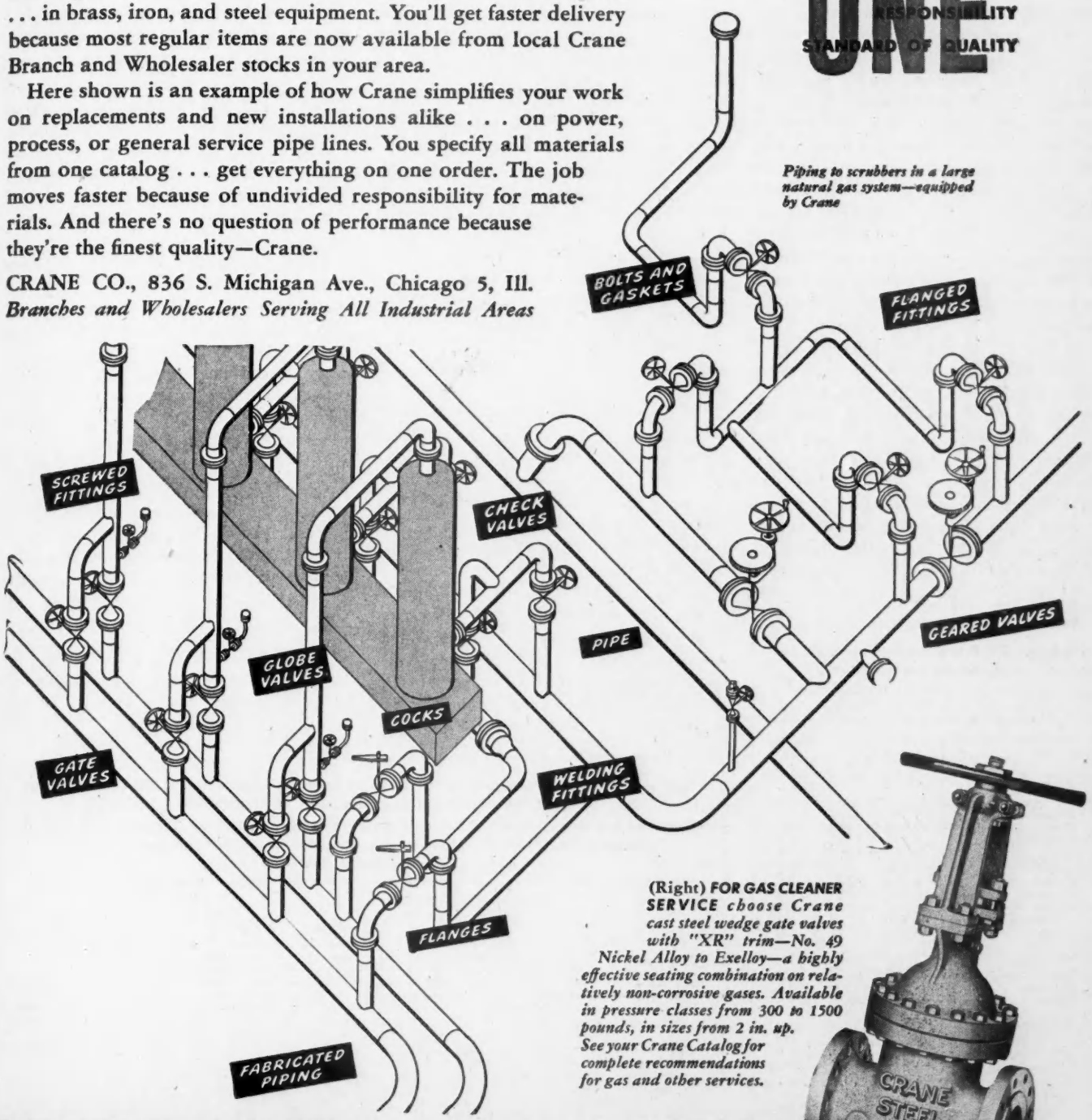

(Right) **FOR GAS CLEANER SERVICE** *choose Crane cast steel wedge gate valves with "XR" trim—No. 49 Nickel Alloy to Exelloy—a highly effective seating combination on relatively non-corrosive gases. Available in pressure classes from 300 to 1500 pounds, in sizes from 2 in. up. See your Crane Catalog for complete recommendations for gas and other services.*

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Midyear Stocks Adequate

PETROLEUM industry inventories of principal refined products were fairly adequate at the middle of 1948, although still relatively light by prewar standards. The level of gasoline stocks was high enough to encourage hope of getting through the summer and fall without serious shortages. Improved positions of fuel oil and kerosine stocks gave promise of the avoidance of critical scarcities of these products next fall and winter. Stocks of all these principal products were larger in volume than at midyear of 1947, although not much if any higher in terms of days' supply, since demand has continued to increase sharply.

In building up stocks of refined products so as to keep abreast of increasing demand, the industry has set new records repeatedly in refinery runs of crude oil. But in charging so much crude to stills, refiners have used not only current production and imports of crude but also have dipped into crude storage to a substantial extent. Therefore, crude stocks were about 12 million barrels lower at midyear 1948 than one year previously.

At 229,632,000 barrels on June 26, 1948, crude inventories were approaching minimum levels that have to be maintained as working stocks. Crude stocks are not greatly above the lowest levels reached during the war, and at those times some refineries were occasionally on the verge of shutting down for lack of crude. Minimum working stocks now required are larger than those in that period because refinery runs are greater and also because there is not now the coordination of operations and supplies which existed during the war under the Petroleum Administration for War. Lowest level reached by crude stocks in the World War II period was 211,813,000 barrels in the week ended August 25, 1945, just as Japan surrendered. That was the lowest point since December, 1921.

Stocks of the principal refined products show increases over a year ago in all refining districts, as a rule. While the Eastern States and the Middle West have experienced scarcities of gasoline, fuel oils, and kerosine during the past year, inventories have been increased considerably over a year ago. This indicates that the threat of shortages is not quite as great as at earlier times within the past year. In reflection of the steady movement of oils into those and other areas, with transportation facilities somewhat expanded, there has been some difficulty in maintaining stocks in the Texas and Louisiana Gulf Coast refining districts. Inventories are only moderately higher than a year ago in those areas, in general, and in some instances stocks are somewhat lower than at that time.

For the U. S. as a whole, stocks of all oils, crude and refined, totaled approximately 516,443,000 barrels at the middle of 1948, an increase of 20 million barrels over the 496,661,000 barrels at the end of June, 1947. This was a 4 percent increase, which was however less than the gain in demand. Therefore, stocks of all oils represented only 83 days' supply at the middle of 1948, whereas those a year previously were equivalent to 86 days' supply. However, crude stocks were down 14 million barrels, while those of refined products (including heavy California crude) were up 34 million barrels or about 13 percent, an increase considerably greater than the gain of about 8 percent in the total demand for all oils.

Crude stocks of 230,697,000 barrels at midyear 1948 were 40 days' supply, while the 242,707,000 barrels held a year previously represented 47 days' supply. Gasoline stocks of 100,861,000 barrels June 30, 1948, were equal to 42 days' supply, whereas the 86,612,000 barrels held a year before were 39 days' supply. In volume, gasoline stocks were up 14 million barrels or 16.5 percent.

Stocks of Crude Petroleum in U. S. by Grades, at End of June

(Based on Weekly Reports of U. S. Bureau of Mines)

(THOUSANDS OF BARRELS)

Grade or Origin	June 28, 1941	June 28, 1947	June 26, 1948
Pennsylvania Grade	4,297	2,354	2,704
Other Appalachian	1,420	1,476	756
Lima-Michigan	1,020	1,026	893
Illinois-Indiana	20,246	11,444	9,976
Arkansas	2,745	2,874	2,649
Kansas	8,755	8,374	8,427
Louisiana	12,439	12,017	11,689
Northern Louisiana	4,424	3,280	3,014
Gulf Coast	8,015	8,737	8,675
Mississippi	1,507	3,012	2,776
New Mexico	7,203	6,071	4,987
Oklahoma	57,158	28,730	26,336
Texas	88,991	120,028	113,634
East Texas	22,698	20,288	16,395
West Texas	16,557	40,666	42,981
Gulf Coast	25,596	33,432	29,049
Other Texas	24,140	25,642	25,209
Panhandle	.....	4,665	3,881
North	.....	6,420	6,995
South	.....	5,681	4,933
Other	.....	8,876	9,400
Rocky Mountain	15,928	9,945	9,111
California	35,125	24,654	22,615
Foreign	2,565	4,216	5,528
Total Gasoline Bearing in U.S.	259,399	236,221	222,081
Heavy in California	10,716	5,445	7,551
Total in U.S.	270,115	241,666	229,632

Stocks of Major Petroleum Products Held by Refining Companies in the United States at End of June, Compared with 1941 and 1947

Stocks at refineries, at bulk terminals, in transit, and in pipe lines. Data from Bureau of Mines except June, 1948, from weekly reports of American Petroleum Institute

(THOUSANDS OF BARRELS)

DISTRICT	FINISHED AND UNFINISHED GASOLINE Stocks End of June			KEROSINE Stocks End of June			GASOIL AND DISTILLATE FUEL Stocks End of June			RESIDUAL FUEL OIL Stocks End of June		
	1941	1947	1948	1941	1947	1948	1941	1947	1948	1941	1947	1948
East Coast	22,698	20,239	25,6 3	1,304	6,214	7,724	10,868	11,436	13,891	7,761	8,782	9,505
Appalachian	3,292	3,293	2,749	166	394	492	376	480	590	539	357	468
District No. 1	.....	2,265	1,924	.....	247	381	.....	352	460	.....	216	354
District No. 2	.....	1,028	825	.....	147	111	.....	128	130	.....	141	114
Indiana, Illinois, Kentucky	17,786	15,895	21,474	1,212	1,697	3,315	3,774	4,085	6,167	3,568	3,385	4,770
Okla., Kansas, Missouri	7,595	7,968	9,166	560	834	1,135	1,397	1,893	3,498	2,066	1,264	1,916
Texas Inland	2,809	3,287	3,290	231	331	744	279	417	559	1,566	676	813
Texas Gulf Coast	13,508	14,930	15,668	3,768	2,214	1,959	8,742	5,840	5,967	8,171	5,321	5,920
Louisiana Gulf Coast	3,351	4,221	5,350	881	1,636	1,524	1,539	2,028	2,900	1,294	1,426	1,412
North La.-Ark	710	1,589	1,890	242	359	534	245	448	452	388	151	270
Rocky Mountain	2,036	2,929	2,828	103	108	218	296	600	988	640	802	1,006
District No. 3	.....	74	80	.....	12	25	.....	24	28	.....	36	28
District No. 4	.....	2,855	2,748	.....	96	193	.....	576	960	.....	766	978
California	16,057	15,423	16,117	1,142	866	961	10,853	12,449	11,509	55,024	21,351	26,390
Total United States	89,842	89,774	104,145	9,609	14,653	18,606	38,369	39,676	46,521	81,017	43,515	52,470

U. S. *Refining*

Operations Set New Records

REFINERY operations in the U. S. have been at remarkably high levels in the first half of this year, setting new all-time records. Instead of offering any excuses for scarcities of oils, the industry is well justified in claiming credit for a near-impossible achievement in boosting refinery throughput to the high levels that have been maintained.

In the first six months of 1948, crude runs to stills averaged 5,490,000 barrels per day, an increase of 627,000 barrels or 12.9 percent over the runs of 4,863,000 barrels per day in the initial half of 1947. The runs this year have been 1,796,000 barrels daily or virtually one half again as great as in the first half of 1941, last prewar year for the United States, when they averaged 3,694,000 daily.

Total volume of crude oil charged to stills in the first half of this year was barely short of a billion barrels. It amounted to 999,173,000 barrels, or 13.5 percent more than the 880,132,000 barrels run in the same period last year. Runs in the first half of 1941 totaled 668,663,000 barrels. All refining districts have processed more crude this year than last year.

In June refinery runs continued to show large increases over last year. For the nation runs averaged 5,644,000 barrels daily. That was considerably more than the daily average of 5,490,000 daily for the first six months. It was 524,000 barrels per day more than the runs of 5,120,000 barrels daily in June of 1947 and was 1,779,000 barrels a day or nearly 50 percent more than the runs of 3,865,000 daily in June, 1941.

In achieving the high refinery runs of this year, the industry has had the benefit of some increase since a year ago in refining capacity. But the principal means by which plant throughput has been increased has been that of pushing actual runs very close to full rated capacity. Virtually all facilities that can be operated are being utilized, including some units that normally would be closed down because of being obsolete or inefficient. All facilities are being operated with a minimum of timeout for repairs and maintenance. Many units are being operated in excess of their rated capacity, with benefit of comparatively new equipment. Several whole districts have been maintaining runs at more than 100 percent of rated capacity, including particularly the East Coast district, the Texas Gulf Coast, and the Louisiana Gulf Coast.

In June the indicated refining capacity in use in the U. S. totaled 5,838,000 barrels daily, from which actual runs of 5,644,000 barrels per day were achieved, indicating an average operating rate of 96.7 percent. In achieving this average, runs went as high as 97 or 98 percent of capacity in individual weeks of June, and more recently they have gone above 99 percent.

The 5,838,000 barrels per day of capacity available in June was 225,000 barrels more than the 5,613,000 barrels available in June of last year, most of the refining districts having gained additional capacity.

However, the plants of a year ago were operating at only 91.2 percent of capacity in June. The present capacity is 1,303,000 barrels per day more than that of 4,535,000 barrels daily available in June, 1941, when plants were operated at 85.2 percent of capacity.

While the nation as a whole was operating plants at 96.7 percent of capacity in June of this year, Louisiana Gulf Coast refineries operated at 116.2 percent, East Coast plants at 108.1 percent, and Texas Gulf Coast plants at 105.0 percent. Close to the national average were Oklahoma-Kansas-Missouri plants, operating at 95.8 percent of capacity. Illinois-Indiana-Kentucky plants operated at 92.6 percent, Rocky Mountain plants at 87.9 percent, and California refineries at 84.4 percent.

U. S. Crude Runs to Stills and Percent of Refinery Capacity Used, by Districts, June and First 6 Months 1941, 1947, 1948
Runs from Bureau of Mines, except May and June, 1948, from American Petroleum Institute. Capacities from American Petroleum Institute
(THOUSANDS OF BARRELS)

REFINING DISTRICT	CRUDE RUNS IN JUNE: Total Amount Run				CRUDE RUNS IN JUNE: Daily Average Run			REFINING CAPACITY IN USE, JUNE: Daily Capacity			REFINING CAPACITY IN USE, JUNE: Percent Capacity Used			TOTAL AMOUNT OF CRUDE RUN TO STILLS, FIRST 6 MONTHS			
	June, 1941	June, 1947	June, 1948	% Diff. '47-'48	June, 1941	June, 1947	June, 1948	June, 1941	June, 1947	June, 1948	June, 1941	June, 1947	June, 1948	Jan.-June, 1941	Jan.-June, 1947	Jan.-June, 1948	% Diff. '47-'48
East Coast	16,955	26,137	26,906	+ 2.9	565	871	897	643	816	830	87.9	106.7	108.1	101,988	144,144	156,109	+ 8.3
Appalachian	4,491	5,025	5,061	+ 0.7	150	168	169	156	195	191	96.2	86.2	88.5	25,924	30,067	30,820	+ 2.5
District No. 1	.....	2,878	3,253	+13.0	.....	96	109	.....	130	123	.....	73.8	88.6	.....	17,012	18,476	+ 8.1
District No. 2	.....	2,147	1,808	—15.8	.....	72	60	.....	65	68	.....	110.8	88.2	.....	12,155	12,344	+ 1.6
Indiana, Illinois, Kentucky	21,225	24,310	27,205	+11.9	707	810	907	743	922	980	95.2	87.9	92.6	118,707	144,326	159,080	+10.2
Oklahoma, Kansas, Missouri	10,831	12,735	13,626	+ 7.0	361	424	454	420	454	474	86.0	93.4	95.8	60,578	72,884	79,986	+ 9.7
Texas Inland	5,551	7,097	7,334	+ 3.3	185	237	244	280	296	297	66.1	80.1	82.2	32,102	39,392	44,727	+13.5
Texas Gulf Coast	28,482	35,625	42,466	+19.2	950	1,187	1,416	1,071	1,328	1,349	88.7	89.4	105.0	171,374	200,167	249,223	+24.6
Louisiana Gulf Coast	4,448	12,014	12,718	+ 5.9	148	401	424	164	357	365	90.2	112 3	116.2	24,859	66,127	77,264	+16.8
North Louisiana and Arkansas	2,124	2,029	2,618	+29.0	71	68	87	101	114	121	70.3	59.6	71.9	13,524	11,348	14,507	+27.8
Rocky Mountain	2,924	4,321	5,004	+15.8	97	144	167	121	187	190	80.2	77.0	87.9	15,805	24,942	29,120	+16.8
District No. 3	.....	362	350	— 3.3	.....	12	12	.....	13	15	.....	92 3	80.0	.....	1,772	2,163	+22.1
District No. 4	.....	3,959	4,654	+17.6	.....	132	155	.....	174	175	.....	75.9	88.6	.....	23,170	26,957	+16.3
California	18,904	24,311	26,370	+ 8.5	630	810	879	836	944	1,041	75.3	85.8	84.4	103,802	146,735	158,337	+ 7.9
Total United States	115,935	153,604	169,308	+10.2	3,865	5,120	5,644	4,535	5,613	5,838	85.2	91.2	96.7	668,663	880,132	999,173	+13.5

Wildcatting At Highest Peak

THE industry is doing an all-time record amount of wildcat drilling this year. Well completions likely will set a record, and of the wells drilled, a larger percentage than formerly represents wildcats.

In the first half of 1948 a total of 2706 strict wildcats were completed, compared with 2084 in the initial half of 1947, as recorded in WORLD OIL of July 28, 1947. These figures exclude tests seeking new pay zones and outposts attempting to extend known fields, being wells trying to open entirely new fields.

These 2706 wildcats of the first six months of 1948 represented 15.2 percent of all wells completed. This was a higher proportion than in the like period last year when wildcats were 14.3 percent of all wells. For the 11 years 1937-1947 only 11.8 percent of all completions were wildcats.

While the number of wildcats drilled in this year's initial half was very large, there was a normal success ratio in the wildcatting, with the result that more new fields were discovered than in earlier years of less wildcatting. Of the strict wildcats completed, 11.5 percent were productive, compared with a ratio of 11.9 percent for the first half of 1947 and 10.9 percent for the 11 years 1937-1947.

With benefit of much wildcatting and an average success ratio, 312 oil, condensate, and gas fields were discovered in the first half of 1948. This was a substantial improvement over the 249 new fields found in the initial half of 1947 and compared with an average of only 365 per year or 182½ per half-year for the 11 years 1937-1947.

Ratio of Wildcatting to all drilling and Proportion of Wildcats Discovering New Fields, by Districts, 1937-1948

STATE OR DISTRICT	ELEVEN YEARS, 1937–1947						FIRST SIX MONTHS, 1948					
		*STRICT WILDCATS						*STRICT WILDCATS				
		Total			Productive			Total			Productive	
	Total Wells Drilled (All Classes)	Number	Percent of All Wells	Dry	Number	Percent of All Strict Wildcats	Total New Wells Drilled (All Classes)	Number	Percent of All Wells	Dry	Number	Percent of All Strict Wildcats
Alabama	181	134	74.0	131	3	2.2	7	7	100.0	7	....	....
Arizona	22	22	100.0	22	....	....	1	1	100.0	1	....	....
Arkansas	2,495	566	22.7	520	46	8.1	138	46	33.3	44	2	4.3
California	16,090	1,977	12.3	1,879	98	5.0	1,257	118	9.4	108	10	8.5
Colorado	658	117	17.8	108	9	7.7	123	25	20.3	25	....	....
Florida	100	93	93.0	92	1	1.1	12	9	75.0	9	....	....
Georgia	35	35	100.0	35	....	....	2	2	100.0	2	....	....
Illinois	26,507	4,772	18.0	4,452	320	6.7	1,028	221	21.5	209	12	5.4
Indiana	4,193	1,025	24.4	929	96	9.4	486	122	25.1	108	14	11.5
Iowa	17	17	100.0	17	....	....	....	....	....	....	....	....
Kansas	21,246	3,346	15.7	2,804	552	16.2	1,409	252	17.9	217	35	13.9
Kentucky	8,507	800	9.4	716	84	10.5	358	26	7.3	24	2	7.7
Louisiana	13,702	1,844	13.7	1,598	246	13.3	1,023	123	12.0	107	16	13.0
North Louisiana	6,526	1,017	15.6	942	75	7.4	643	56	8.7	51	5	8.9
South Louisiana	6,966	827	11.9	656	171	20.7	380	67	17.6	56	11	16.4
Maryland	2	2	100.0	2	....	....	1	1	100.0	1	....	....
Michigan	9,678	2,686	27.8	2,489	197	7.3	310	118	38.1	110	8	6.8
Mississippi	2,079	704	33.9	676	28	4.0	192	40	20.8	40	....	....
Missouri	762	168	22.0	164	4	2.4	26	3	11.5	3	....	....
Montana	2,620	170	6.5	141	29	17.1	139	16	11.5	15	1	6.3
Nebraska	280	160	57.1	157	3	1.9	1	....	....	....	....	....
New Mexico	5,511	577	10.5	511	66	11.4	303	38	12.5	30	8	21.1
New York	12,310	12	0.1	12	....	....	852	....	....	....	....	....
North Carolina	7	7	100.0	7	....	....	....	....	....	....	....	....
North Dakota	9	2	22.2	2	....	....	....	....	....	....	....	....
Ohio	12,939	290	2.3	250	40	13.8	607	19	3.1	18	1	5.3
Oklahoma	24,793	3,256	13.1	2,697	559	17.2	1,870	253	13.5	217	36	14.2
Oregon	4	4	100.0	4	....	....	....	....	....	....	....	....
Pennsylvania	41,680	33	0.1	16	17	51.5	1,581	3	0.2	3	....	....
South Carolina	4	4	100.0	4	....	....	....	....	....	....	....	....
South Dakota	11	11	100.0	11	....	....	1	1	100.0	1	....	....
Tennessee	300	116	38.7	110	6	5.2	28	20	71.4	19	1	5.0
Texas	96,894	13,721	14.2	12,167	1,554	11.3	5,464	1,190	21.8	1,036	154	12.9
Dist. 1—South Central	2,935	1,178	40.1	1,121	57	4.8	228	90	39.5	89	1	1.1
Dist. 2—Middle Gulf	[1]	[1]	[1]	[1]	[1]	[1]	371	107	28.8	94	13	12.1
Dist. 3—Upper Gulf	9,025	1,463	14.7	1,278	185	12.6	502	139	27.7	125	14	10.1
Dist. 4—Lower Gulf-S.W.	20,281	3,829	18.8	3,381	448	11.7	655	178	27.2	157	21	11.8
Dist. 5—East Central	[2]	[2]	[2]	[2]	[2]	[2]	99	41	41.4	39	2	4.9
Dist. 6—Northeast	10,989	1,229	11.2	1,147	82	6.7	179	36	20.1	33	3	8.3
Dist. 7-B—North Central	[3]	[3]	[3]	[3]	[3]	[3]	626	232	37.1	187	45	19.4
Dist. 7-C—West Central	[4]	[4]	[4]	[4]	[4]	[4]	183	52	28.4	45	7	13.5
Dist. 8—West	21,033	1,556	7.4	1,347	209	13.4	1,345	107	8.0	81	26	24.3
Dist. 9—North	26,116	4,373	16.7	3,806	567	13.0	1,017	206	20.3	184	22	10.7
Dist. 10—Panhandle	5,515	93	1.7	87	6	6.5	259	2	0.8	2	....	....
Utah	33	17	51.5	17	....	....	12	12	100.0	11	1	8.3
Virginia	4	4	100.0	3	1	25.0	1	1	100.0	....	1	100.0
Washington	7	7	100.0	7	....	....	2	2	100.0	2	....	....
West Virginia	8,813	40	0.5	25	15	37.5	359	2	0.6	....	2	100.0
Wyoming	1,658	208	12.5	157	51	24.5	193	35	18.1	27	8	22.9
Total United States	313,851	36,947	11.8	32,932	4,015	10.9	17,786	2,706	15.2	2,396	312	11.5

* Exclusive of all tests seeking new pay zones or outposts attempting to extend known fields.

[1] Dist. 2 included with Dist. 4. [2] Dist. 5 included with Dist. 6. [3] Dist. 7-B included with Dist. 9. [4] Dist. 7-C included with Dist. 8.

Footage Much Greater in 1948

IN THE first six months of 1948 the average depth of all new wells completed was 3460 feet, one foot more than the average for the first half of 1947. Since this year is bringing materially more well completions than last, footage being drilled in 1948 is much greater than in 1947. It now seems very likely that more wells will be completed in 1948 than ever before. It is certain that footage drilled will set an all-time record because of the relatively large number of wells and the comparatively great average depth of today.

The 3460-foot average depth for wells completed in the first six months of this year reflects the increasing necessity of going to lower levels to develop production. For the past 15 years the average depth of wells completed has been gradually increasing, and the trend has been accentrated in the last several years. In 1934 well completion depths averaged 2658 feet. By 1938 the average exceeded 3000 feet but it then held steady for six years between 3000 and 3100 feet. Then the average increased to 3272 feet in 1944, 3489 feet in 1945, dropped back to 3331 feet in 1946, but increased again to 3416 feet in 1947. This year as a whole may or may not exceed the 1945 record of 3489 feet per well. Completions in the first half of 1948 did not quite equal that record set in 1945.

A new record in footage drilled is virtually assured for this year, with 61,536,959 feet of hole made in 17,786 wells completed in the first six months. In the first half of 1947 there were 14,630 new wells involving 50,607,227 feet of hole. In the whole of last year, 33,013 wells were completed at depths aggregating 112,784,995 feet. The completions of 1947 were about 2000 short of the record number drilled in 1937, but the footage drilled in 1947 was an all-time record, having materially exceeded the 104,733,341 feet drilled in 1937, when wells averaged only 2989 feet in depth. As in 1947, it is customary for the industry to drill more wells in the latter half of a year than in the first half. But even if the latter half of 1948 brought only the same number of completions as the first half, there would be more than 35,500 wells completed for a new record, and the footage involved in those completions would be more than 120 million feet, compared with the record 112,784,995 feet of 1947.

In deep drilling, South Louisiana remains the leading district, having had in the first half of this year an average completion depth of 9050 feet. The adjacent state of Mississippi ranks second in deep drilling, with an average depth of 8212 feet. The upper Texas Gulf Coast ranks third, with wells averaging 6662 feet. Florida's 12 completions of this year averaged 6095 feet. In the middle section of the Texas Gulf Coast, centering around the Refugio area, wells averaged 5952 feet.

Colorado had an average completion depth of 5503 feet in the first half of this year, and the average for East Texas was more than 5000 feet. Although California has some deep wells and formerly had a relatively great average drilling depth, it had an average of only 3559 feet in the first half of this year, or not much more than the national average. In the first half of last year California wells averaged 4255 feet.

Wells, Footage and Average Depths Drilled in U. S., by States and Districts, First Half of Year 1947-1948

STATE OR DISTRICT	NEW WELLS					
	Wells		Footage		Average Depth	
	1947	1948	1947	1948	1947	1948
Alabama	9	7	34,233	34,360	3,804	4,909
Arizona	....	1	.....	630	....	630
Arkansas	119	138	514,631	557,808	4,324	4,043
California	909	1,257	3,867,423	4,473,573	4,255	3,559
Colorado	79	123	426,081	676,838	5,393	5,503
Florida	17	12	88,288	73,140	5,193	6,095
Georgia	1	2	3,847	8,871	3,847	4,436
Illinois	890	1,028	2,295,051	2,628,587	2,579	2,557
Indiana	254	486	468,198	896,563	1,843	1,845
Kansas	1,080	1,409	3,498,203	4,628,620	3,239	3,285
Kentucky	392	358	729,411	719,492	1,861	2,010
Louisiana	617	1,023	3,735,821	5,159,720	6,055	5,044
North Louisiana	323	643	1,083,001	1,720,594	3,353	2,676
South Louisiana	294	380	2,652,820	3,439,126	9,023	9,050
Maryland	....	1	.....	5,259	....	5,259
Michigan	278	270	643,713	720,506	2,316	2,324
Mississippi	213	192	1,808,616	1,576,764	8,491	8,212
Missouri	26	26	12,421	8,442	478	325
Montana	73	139	175,597	351,540	2,405	2,529
Nebraska	....	1	.....	4,965	....	4,965
New Mexico	260	303	1,137,430	1,277,995	4,376	4,218
New York	796	852	1,129,737	1,240,700	1,419	1,456
North Carolina	1	....	6,370	.....	6,370	....
Ohio	617	607	1,806,853	1,583,616	2,928	2,609
Oklahoma	1,734	1,870	5,327,257	6,684,633	3,072	3,575
Oregon	1	....	8,500	.....	8,500	....
Pennsylvania	1,595	1,581	2,775,165	2,759,786	1,740	1,746
South Dakota	....	1	.....	1,365	....	1,365
Tennessee	9	28	7,192	40,783	799	1,457
Texas	4,194	5,464	18,589,021	23,636,523	4,432	4,326
Dist. 1—South Central	146	228	535,409	737,014	3,667	3,233
Dist. 2—Middle Gulf	295	371	1,834,068	2,208,020	6,217	5,952
Dist. 3—Upper Gulf	374	502	2,420,771	3,344,493	6,473	6,662
Dist. 4—Lower Gulf-S.W.	534	655	2,905,424	3,243,143	5,441	4,951
Dist. 5—East Central	62	99	334,741	495,832	5,399	5,008
Dist. 6—Northeast	223	179	1,133,733	1,005,069	5,084	5,615
Dist. 7-B—North Central	382	626	1,205,827	1,970,938	3,157	3,147
Dist. 7-C—West Central	117	183	404,029	713,327	3,453	3,898
Dist. 8—West	876	1,245	4,450,028	6,198,652	5,080	4,609
Dist. 9—North	963	1,017	2,596,458	2,868,424	2,696	2,820
Dist. 10—Panhandle	222	259	768,533	852,311	3,462	3,291
Utah	3	12	14,143	48,272	4,714	4,023
Virginia	....	1	.....	2,301	....	2,301
Washington	....	2	.....	11,205	....	5,603
West Virginia	370	359	1,054,175	925,295	2,849	2,577
Wyoming	93	193	449,650	798,657	4,835	4,138
Total United States	14,630	17,786	50,607,227	61,536,957	3,459	3,460

Combined Footage and Average Depths Drilled in New Wells Completed in U. S.

YEAR	Wells	Footage	Average Depth
1934	21,122	56,141,433	2658
1935	24,581	67,844,939	2760
1936	28,962	80,996,816	2797
1937	35,045	104,733,341	2989
1938	29,127	90,585,159	3110
1939	28,012	85,523,094	3053
1940	31,149	96,182,605	3088
1941	32,510	99,347,714	3056
1942	21,990	67,909,053	3088
1943	20,349	61,991,857	3046
1944	25,786	84,378,457	3272
1945	26,649	92,982,113	3489
1946	30,333	101,025,789	3331
1947	33,013	112,784,995	3416
First Half:			
1947	14,630	50,607,227	3459
1948	17,786	61,536,959	3460

New Strikes Add Vast Area to PERMIAN BASIN

By H. H. KING

THE largest area of unexplored pre-Permian beds in the Permian Basin sector of West Texas-New Mexico now is rated as a potentially important source of deep production through the completion of Mid-Continent Petroleum Corporation's 12,215-foot Devonian formation discovery on the Cross Roads geophysical prospect in northeastern Lea County, N. M.

This isolated wildcat has sparked a major lease buying program which is penetrating areas that are being leased for the first time. The deep-seated structure was outlined by reflection seismograph methods that incorporated technique and equipment perfected in recent years for the detailing of structures underlying thick beds of Permian.

Mid-Continent's discovery is the deepest producer in the Permian Basin and is the first Devonian formation strike in New Mexico. It is 2¾ miles east and 8¾ miles west by south of small pumping discoveries in the 4900-foot San Andres. Nearest pre-Permian production involves a single Pennsylvanian (Strawn) flowing well in the Landon field, Cochran County, 21 miles southeast. The Jones Ranch field, northwestern Gaines Conuty, Texas, and 40 miles southeast of the record depth producer, heretofore held the distinction of being the only Devonian oil area north of the Central Basin Platform region. Leases and royalty are in great demand along a direct strike between the two isolated Devonian areas on the supposition that a production trend exists with a series of fields.

Production trend plays in the Permian Basin have been remarkably successful in the past. The Cross Roads strike is 73 miles north of New Mexico's nearest pre-Permian producing area, consisting of the Brunson, Hare, and McCormick fields near Eunice. The latter also produces from the Ellenburger, Simpson and Silurian.

COMPLETION OF A 12,215-foot well in New Mexico by Mid-Continent Petroleum Corporation has opened up possibilities for important new deep production from hitherto unexplored pre-Permian beds in this section. Active lease buying and geophysical programs are already under way as a result of the discovery and a number of companies have begun drilling operations in the surrounding area.

Large Production Indicated

Geophysical data on the discovery area indicates it will be a substantially large producing structure. This appraisal is confirmed by the size of cash bonuses paid for outlying lease protection.

The discovery is south of a barrier of buried granite mountains that mark the northern boundary of production for the South Permian Basin. Nearest production to the north is the Permian pays in the Texas Panhandle. This barrier is identified as the Matador Arch in geological circles. It extends east from New Mexico across the Texas plains to link with the Electra Arch in North Texas. The apex of the barrier has accounted for a Permian (Clear Fork) field and a cluster of three Pennsylvanian one-well pools. No significant oil or gas showings have been encountered by decisive tests on the north slope of the Matador Arch. Pre-Permian beds are generally absent, else comparatively thin upon and adjacent to this granite uplift.

The position of the Cross Roads discovery to the Matador Arch will stimulate deep prospecting on the south slope and also in a general east-west direction. Some decisive failures at about the same relative position have been drilled in Texas but these will not discourage further prospecting on adjacent blocks in the event favorable geophysical information prevails.

Absence of any appreciable folding or structural relief in the Permian as it recedes south from the Matador Arch in counties near the state border complicates efforts to work the section with geology or geophysics. However, the Slaughter field, largest in the district and now being linked with the Levelland area, is less than a width of a county to the south of the granite barrier. The Permian beds do not reflect the steep and sharply faulted pre-Permian structures that have been located on the south slope by deep drilling and through the introduction of more efficient geophysical activity.

Lease Speculation

An aggressive geophysical and lease play is under way in the bi-state area as a result of the opening of this new territory. Lease speculators are attempting to jump ahead of the concentrated buying. The Ellenburger will be the prime objective of the majority of the wildcats to follow due to its normally high average crude yield per acre, but the cost of drilling these deep holes will narrow the group of participants.

Devonian and Simpson beds are not present upon the barrier nor in random decisive tests drilled immediately north or south of the Texas sector. This excludes two prospective pre-Permian producing zones for a sizeable area. However, the Pennsylvanian, Mississippian and Ellenburger zones prevail, except when the section is cut short by protruding granite peaks.

The north half of Lea County contains the largest area in the Permian Basin that has not been explored below the Permian. Mid-Continent's discovery is 54 miles northeast of the county's nearest pre-Permian test, a 13,998-foot failure in the Pennsylvanian on the east flank of

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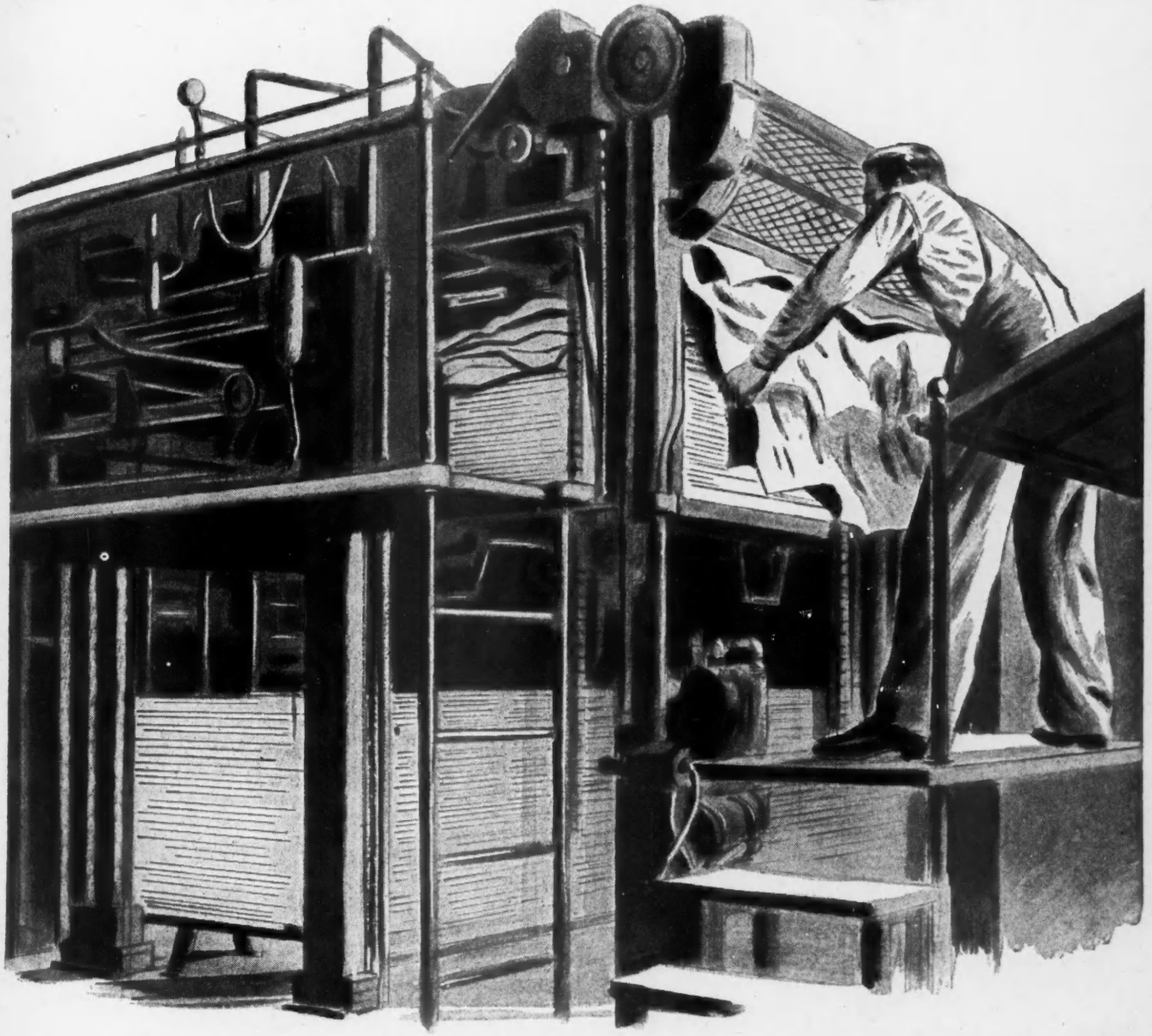

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the Maljamar field. This failure holds the depth record for the state. Along a north-south trend across the county the Cross Roads area is 60 miles north by east of a 13,524-foot Devonian failure on the west side of the Central Basin Platform. The county's third nearest pre-Permian test is 61 miles south by east, and it logged Permian on Devonian and Simpson on granite in abandoning at 10,580 feet. A 10,085-foot failure 18 miles north of the latter was abandoned in Basal Permian. Its unusually low structural position may have discouraged deep prospecting farther north in Lea County.

The upper region of Lea County will receive the greatest volume of the new activity in geophysical work, leasing and deep explorations. Heretofore, interest has been largely on a routine basis, with prices on long-term leases below the average for the Permian Basin. The infrequent exploratory tests given this sector invariably quit in the Permian beds. Subsurface information developed from these tests proved of little value in attempts to detail pre-Permian structures. It is possible that some operators preferred to postpone deep prospecting until crude oil transportation facilities assure an adequate production allowable per well to justify the expense. Adequate transportation and market demand will be provided for all southeastern New Mexico areas late this year.

Shallow Permian Beds

Geological information derived from deep failures in southeastern Chaves County, which adjoins the upper portion of Lea County on the west, stimulated the westward sweep of the new activity. These tests reveal that potential oil producing pre-Permian beds prevail at reasonably shallow depths. No important pre-Permian shows have been recorded, but the presence of a regional high will influence prospecting to the east.

The Pennsylvanian is present in all southeastern Chaves County deep tests. Other prospective pre-Permian sources of production logged by these wildcats include Mississippian, Devonian-Silurian, Simpson, and Ellenburger in the majority of the tests. The shallowest Ellenburger is 6003 feet. Richfield Oil Corporation's White 1, Lease 3, C SE SW 6-12s-29e, situated 50 miles west by south of the Cross Roads discovery, entered Ellenburger at 8700 feet, and abandoned in igneous rock at 9040-9058 feet.

Roosevelt County is among the most sparsely explored in New Mexico. Its two pre-Permian tests encountered Pennsylvanian overlying igneous rock. Shell Oil Company's Harwood 1, SE SE 27-7s-35e, was the first pre-Permian test for southeastern New Mexico, and when abandoned in igneous rock, topped at 7954 feet, became the western anchor of the Matador Arch as later deep failures traced its course across the Texas Plains. Harwood 1 is 13½ miles north by west of Mid-Continent's strike, with a difference of 4304 feet in depth. The county is currently receiving its greatest volume of lease buying.

During the initial stages of outlining the course of the Matador Arch across the north rim of the Permian Basin an aggressive lease play was staged in Texas. Meager subsurface data available at that time pointed to the possibility of a repetition of the Texas Panhandle's gas and oil accumulation along a buried mountain range. This theory failed to materialize fully, but the long-term leases acquired on the south slope are now in great demand.

Highest Granite

The highest granite encountered in Texas for the Permian Basin sector of the Matador Arch is Humble Oil & Refining Company et al's Byrd 1, southeastern Hale County wildcat. It logged Mississippian on igneous rock at 6745 feet. The test was later reworked for a small pumping discovery from the Pennsylvanian. Two nearby tests missed the oil zone, thereby discounting the area's importance.

Cochran County's two deep failures present an interesting subsurface picture. Stanolind Oil & Gas Company's Slaughter 1, 31 miles east by north of the Cross Roads area, establishes an almost normal section of pre-Permian beds within a nominal distance of the Matador Arch. The Wolfcamp, or Basal Permian, was entered at 8358 feet. The Strawn, or first identified member of the Pennsylvanian, was called at 9540 feet, followed by Bend at 9890 feet and Mississippi at 9940 feet. The 387-foot zone of Ellenburger, topped at 10,383 feet, is especially significant in view of the thickness and unusual porosity. Numerous Ellenburger drill-stem tests were made as drilling progressed to granite at 10,770 feet. These yielded salt water or else were incomplete, but the company elected to set pipe at 10,370 feet for a decisive production test before abandoning at 10,840 feet. Humble's Westheimer-Daube 1, 10 miles northwest of this prospect and on the Matador Arch, entered igneous rock at 7390 feet, with all pre-Permian beds absent. Subsea correlation of the granite top of the two failures reveals a difference of 3466 feet in depth, or an average of 347 feet per mile.

Mid-Continent Strike

Mid-Continent Petroleum Corporation's deep strike was originally projected to the 5500-foot San Andres, starting August 31, 1947. A series of drill-stem tests in the 4800-4900-foot porous section of the San Andres proved dry, although this zone correlated high to all tests in the northeast portion of Lea County.

New depth goals were set as drilling progressed on a routine basis. The Glorietta, first potential source of production below the San Andres, was eliminated by a negative drill-stem test at 5830-5957 feet. The customary fair to good oil or gas showings encountered in the Permian by the majority of the deep strikes in the Permian Basin also were noticeably absent.

Encouragement from a geological viewpoint arose when Sawyer 1-A logged the Permian-Pennsylvanian contact and underlying markers at subsea depths comparable to the single deep producer in the Landon-Strawn field, situated 21 miles southeast in Cochran County. The Strawn sand was entered at 10,560 feet, or 74 feet low. However, this relatively flat correlation proved without significance for Sawyer 1-A as the Strawn was barren of production, and the lower beds were thicker. The Mississippian was entered at 11,565 feet, correlating 439 feet low. Nominal oil staining in the upper section induced the owner to make a routine drill-stem test at 11,575-609 feet, resulting in the recovery of 15 feet of rotary fluid. The Landon-Strawn field discovery drilled only 266 feet in the Mississippian in plugging back from 11,166 feet.

Sawyer 1-A logged 541 feet of Mississippian in entering the Devonian at 12,106 feet. Drill-stem tests at 12,181 and 12,214 feet confirmed commercial production. Final test at 12,214-249 feet yielded 110 feet of clean oil besides slightly oil-cut water cushion. Following an electrical formation survey at this depth the well was deepened to 12,258 feet in dolomite for completion.

Surface Pipe

Surface pipe consists of 214 feet of 13⅜-inch, while a protection string of 9⅝-inch was cemented at 3706 feet. No difficulty was encountered in carrying 8552 feet of open hole for the landing of the 5½-inch oil string at 12,255 feet, or 3 feet off bottom.

Cement was not drilled out from the lower joints of casing in completing May 11 from 600 perforations at 12,115-215 feet, with 2½-inch tubing at 12,228 feet. The perforations were washed with 1000 gallons of mud acid.

The well recorded a potential of 3744 barrels of 42.6 gravity oil, with gas-oil ratio of 260/1, based upon an actual gauge of 6⅓ hours through a ¾-inch tubing choke. Back pressure on tubing during this test was 200 pounds, while shutin pressure on the casing was 50

SOUTHERN

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REFLECTION

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DATA REANALYSIS

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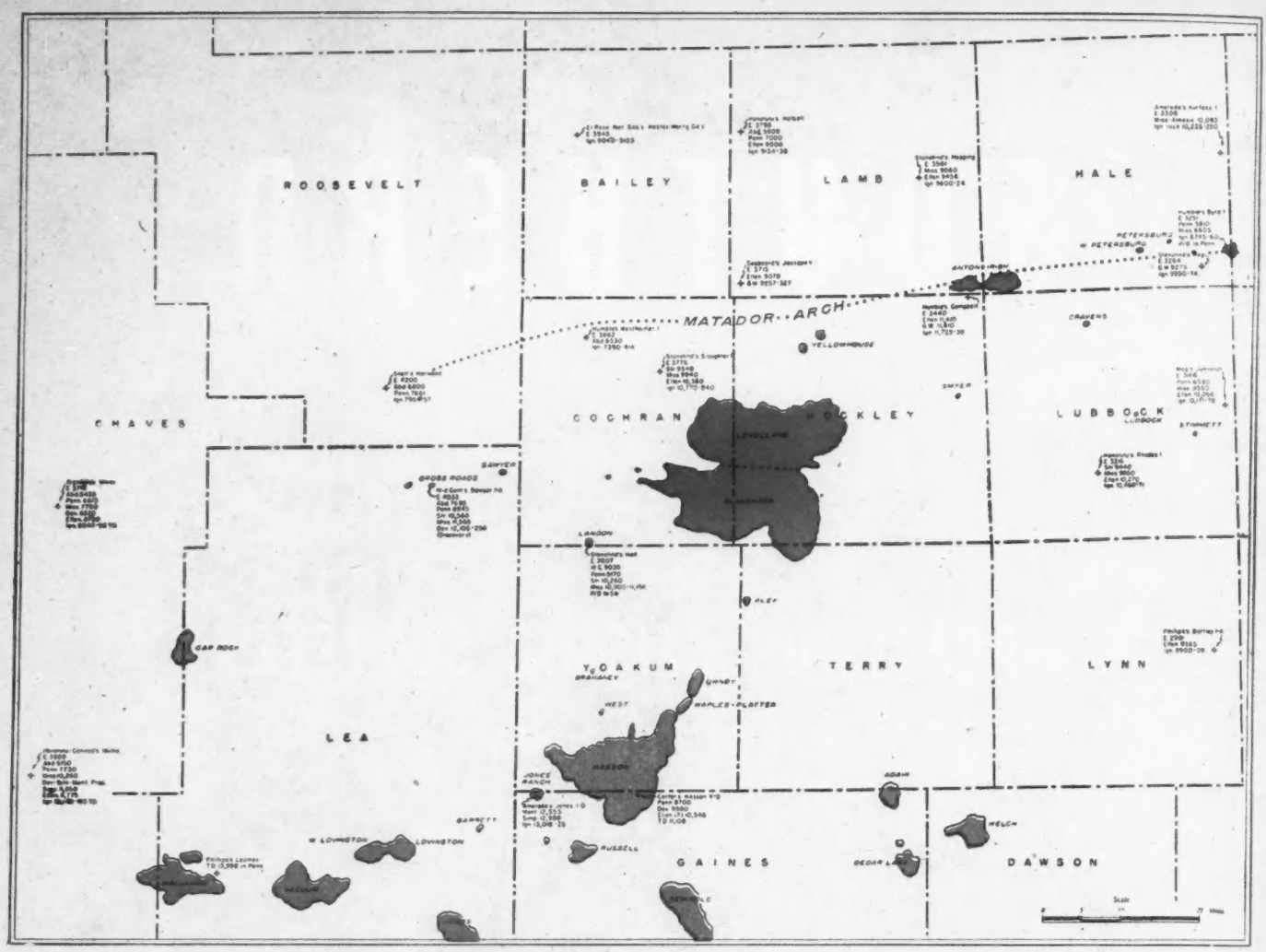


Largest area of unexplored pre-Permian beds in the Permian Basin has been opened for exploration by a prolific Devonian strike in extreme northeastern Lea County. This map shows its location with respect to other producing fields in the region.

Map by Southwestern Mapping Company, Fort Worth

pounds. The shutin bottom-hole pressure at the pay-level recorded 4650 pounds in 15 minutes. The comparatively low gas-oil ratio and surface pressure readings fall within the average for the Devonian wells in the Jones Ranch field, which has five 11,300-foot Devonian wells that have an average of 95 feet of exposed pay each.

An analysis of the crude places it within the sweet oil classification. The sulphur content is 0.39 percent, being slightly higher than the average for other Devonian crudes in the Permian Basin. It will be desirable for the manufacture of lubes. The residual fuel content is unusually low, while kerosine, gas, oil and distillate will comprise about two-thirds of the refinery yield. The gasoline content has an octane rating of 18 and is subnormal for Devonian oil. A preliminary breakdown of the refining value follows: 23 percent of 375 end point gasoline; 30 percent kerosine; 24.4 percent gas oil; 12.3 percent distillate; and 10 percent residual fuel.

A temporary allowable of 244 barrels of oil daily was assigned the discovery, but Mid-Continent has made application for a 500-barrel daily quota. New Mexico's production allocation schedule has failed to provide for wells below 12,000 feet.

Mid-Continent completed its discovery in an elapsed period of eight months and ten days, including time out to change from a light to a heavy rotary. Future completions are likely to reduce the drilling time to about six months, as operators will probably forego the taking of cores and making drill-stem tests above the Devonian. The offsets and outposts under way are expected to cost an average of $250,000 each.

Four locations were spotted immediately after commercial production be-

■ CONTINUED ON PAGE 69

Geological Table of Deep Tests Near Cross Roads Discovery
(All Figures in Feet)

	WELLS				
	Mid-Continent Petroleum's Sawyer 1-A, Lea County	Shell's Harwood 1, Roosevelt County	Stanolind's Hall 1, Cochran County	Stanolind's Slaughter 1, Cochran County	Humble's Westheimer-Daube 1, Cochran Co.
Elevation	4,033	4,200	3,807	3,776	3,862
Yates	2,850	2,380	.....	.....	.....
Brown lime	.....	.....	3,970	3,510	.....
San Andres	4,110	3,495	4,285	3,782	3,370
Glorietta	5,455	4,590	.....	5,190	4,680
Clear Fork	.....	.....	6,430	5,800	5,280
Tubb	.....	.....	.....	6,240	.....
Wichita-Albany	.....	.....	.....	7,000	.....
Abo	7,695	6,800	.....	.....	6,530
Wolfcamp	.....	.....	9,035	8,358	.....
Pennsylvanian	8,915	7,661	9,170	.....	.....
Cisco	.....	.....	9,790	.....	.....
Canyon	.....	.....	9,990	.....	.....
Strawn	10,560	.....	10,300	9,215	.....
Bend	11,260	.....	.....	9,890	.....
Mississippian	11,565	.....	10,900	9,940	.....
Devonian	12,106	.....	.....	.....	.....
Ellenburger	.....	.....	.....	10,380	.....
Granite	.....	7,954½	.....	10,770	7,390
Total Depth	12,258	7,957	11,166	10,840	7,414
Oil Pay	12,115–215	.....	10,410–541	.....	.....

U.S. Oil Findings

CAN MEET NEEDS IN NEXT FEW YEARS!

By G. H. WESTBY
President, Seismograph Service Corporation

TO PROVIDE enough petroleum to meet the large and still growing demand, the U. S. petroleum industry henceforth must carry on an aggressive campaign of finding and developing new reserves. If reserves are kept on the same ratio to annual production as at present, then the industry during the next several years must develop new reserves in the average amount of 2,600,000,000 barrels per year. In the years immediately ahead the industry can keep reserve finding abreast of the increasing demand, provided it carries on an energetic program of development and is aided and not hindered by government. To succeed, the industry must intensify exploration. It must have more geologists, more geophysical crews, and more imagination and ingenuity. Finally, the industry must have the steel to drill and develop the reserves that are discovered. This article was presented in slightly longer form as a paper to the International Petroleum Congress at Tulsa, May 21, 1948, under title, "The Future of Oil Exploration."

THE greatest problem facing the American oil industry today, as well as the oil industry of the world, is to provide a supply of crude petroleum to meet the ever-increasing demand. The solution to this problem involves all of the many phases of the petroleum industry, but it is my purpose to discuss only the primary phase, that of the exploration for new petroleum reserves.

Domestic demand for petroleum products in 1947 reached the startling total of 1,850,000,000 barrels per year. Conservative estimates for the future indicate that for only normal peacetime consumption this demand is estimated to increase to 2,200,000,000 barrels per year by 1951. In 1938 per capita U. S. consumption of petroleum products was 367 gallons, while by 1947 it had risen to 608 gallons. We have undeveloped reserves at the present time of some 22 billion barrels, which, in ratio to the current yearly consumption, is a reserve of 11.1 years. To maintain our present ratio in regard to the number of years of supply on hand, along with the increasing demand, it will be necessary for the exploration phase of the oil industry to discover 10,400,000,000 barrels for the period from the present to the end of 1951, or an average of 2,600,000,000 barrels per year.

Reserve vs. Consumption

To accentuate our domestic problem of exploration, it is necessary only to glance at the world balance of crude oil reserves against consumption. The U. S. at present has 31.2 percent of the world's known reserves but consumes 63 percent of the world output. The Western Hemisphere, as a whole, has 45 percent of the world's reserves and consumes 82 percent. Russia has 11 percent, the Middle East 40.8 percent, and the total Eastern Hemisphere, including these two, has 55 percent of the known oil reserves. The Middle East, with approximately 41 percent of the world's reserves, consumes only 9 percent of the world output. With a total of only 600 wells drilled in all the Middle East, its reserves exceed those of the U. S. by 10 percent, and here we have drilled more than 1 million wells. It is quite apparent that the problem outside the U. S., particularly in the Middle East, is one mainly of development, and that the problem of structural discovery is relatively simple. The disproportionate use of petroleum by the Western Hemisphere in relation to the world's reserves and the relative ease of discovery in the Eastern Hemisphere clearly emphasize one of our country's main strategic problems, as well as the exploration problem of the American oil industry.

There is only a finite number of oil fields in the U. S. which man must use his ingenuity and effort to locate. It is obvious that in any undeveloped area those fields easiest to find, requiring the least effort and ingenuity, will be found first, and that for each one found, there is one less to find. If we may designate major fields as those which will eventually produce over 10 million barrels of oil, we find that 39 such fields were found in 1938, representing 17.5 percent of all the fields found that year, while in 1945 only five such fields, representing 2.34 percent of all the fields found that year, were discovered. The American Association of Petroleum Geologists points out that in 1939 the average reserves developed per wildcat well were 885,589 barrels. This figure dropped to 383,828 in 1943, and went back up to 517,944 in 1946. From the same source we find that the new reserves per foot of wildcat drilling was 270.9 barrels in 1939, but decreased to 133.1 barrels per foot of wildcat drilling in 1946. These figures are significant in that they reveal that despite an intensification of the exploration activities during this period, as shown on the chart, the larger fields have

About the Author

GERALD H. WESTBY, president of Seismograph Service Corporation, Tulsa, majored in geology at the University of Chicago and after his graduation in 1920 he became resident geologist in Algeria for S. Pearson & Son of London. From 1924 to 1927 he was field geologist for Empire Oil & Refining Company with field office at Denver, Colo., and was chief geophysicist for Empire from 1927 to 1933. Since 1933 he has been associated with Seismograph Service Corporation.

been found and more of the smaller complex structures are being revealed.

Before becoming too pessimistic about these facts, we must examine the figures of reserves added each year. As you know, calculations of reserves are subject to considerable errors and are extremely difficult to determine. The usual presentation provides figures on the reserves of new fields discovered during the year, but this calculation is usually greatly affected by revisions of previous estimates and extensions made to known fields. We can from this reasonably assume that the reserve figures calculated for new fields discovered during each year are always very much too low, since information is not immediately available as to the size of the reservoir or the number of possible producing horizons. The total figure, however, can be taken from any year as representing not only the new fields found that year but part of the reserves of fields found some years before, so that the total picture will provide an average of oil fields found during each year.

Reserves and Exploration Activity

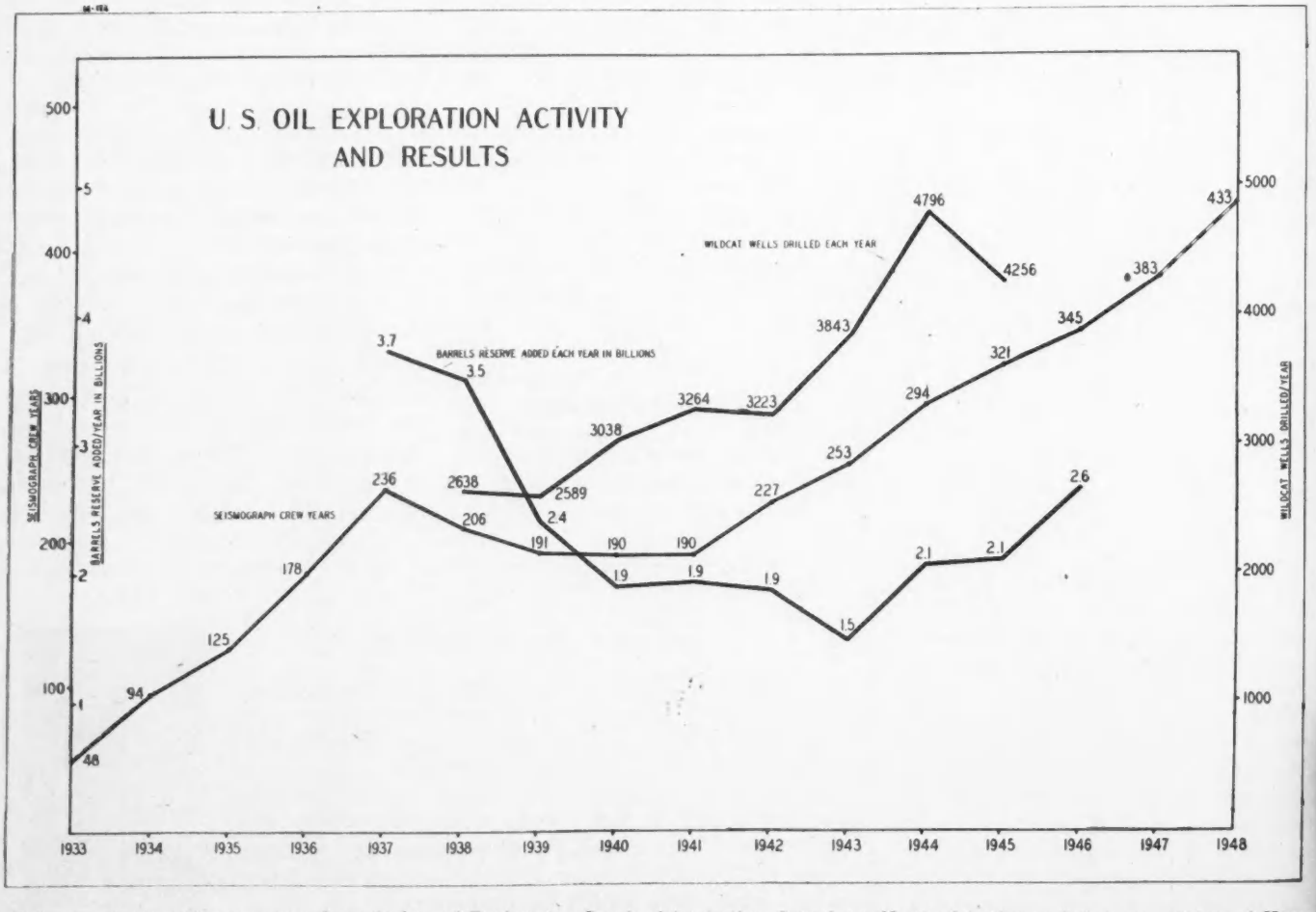
It is revealing to compare the reserves developed each year with exploration activity in order to provide some basis of forecasting future possibilities. The chart shows the number of seismic crews operating in the U. S. east of the Pacific Coast region from 1933 to 1947, together with a curve of the number of wildcat wells drilled each year and the calculated reserves provided by such activity for each year. While it is very erroneous to assume that the seismic operations represent all of exploration, nevertheless it is true that the index of seismic activity is certain to represent the general level of all exploration work during these years. It is also obvious that exploration activity of one year will not be indicated by a gain or loss in reserves until a delay period of from one to two years, since opportunity after structural discovery must be had for leasing and drilling.

It seems apparent that the drop in seismic activity from 1937 to 1941, which represents the general drop in exploration activity during these years, is largely responsible for the decline in reserves discovered, which declined to a low point in 1942. This represents approximately the proper time lag between these two curves. It is important that the increase in general exploration activity beginning in 1942, as shown by the increase in seismic crews in operation, is followed by an increase in the reserves found each year in a manner which is remarkably parallel. It is also noteworthy that the reserve curve bears a much closer relation to the structural exploration activity than it does to the curve of the number of wildcat wells drilled each year, since despite an increase in the number of wells drilled, the curves of reserve show a definite sag which is not apparent in the curve of the wildcat wells drilled.

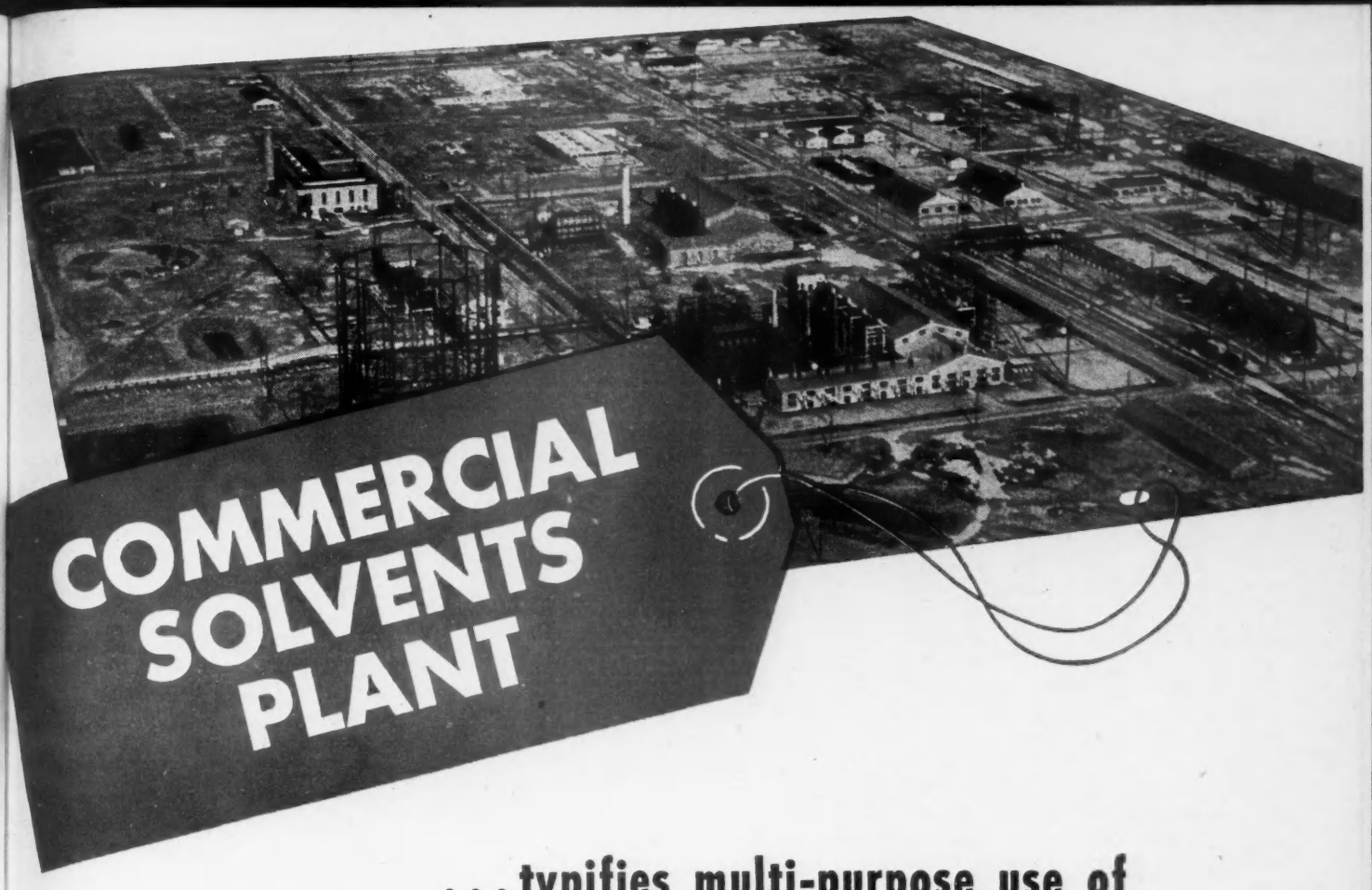
Despite the clear evidence, therefore, of the increasing difficulty of finding new oil fields and the great decline in size of new oil fields discovered on the average, we do have evidence which still indicates that by increasing exploration activity, or as we may say, by running fast enough, we can still keep ahead of the increasing demand for crude petroleum.

There is no man who can state how long this process of keeping ahead of demand may continue in the U. S., but it is reasonably certain that in the next several years ahead we may be able to keep our new-found reserves ahead of demand.

To place the burden of finding 2,600,-



Data on seismograph crew years from Society of Exploration Geophysicists; other data from digest of testimony before committees of House of Representatives by Max W. Ball, director of Oil and Gas Division of Department of Interior, except where text specifically mentions American Association of Petroleum Geologists as source.



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SETS THE PACE IN COMPRESSOR PROGRESS

000,000 barrels of new oil per year compeltely on the activities of seismic crews, we would presently make each seismic crew in the U. S. responsible for the discovery of approximately 5 million barrels of new oil per year. While a few years ago this was an entirely reasonable assignment, it is quite evident at the present time that even with 500 crews operating in the U. S., it does not seem logical or possible for each to average 5 million barrels of oil discovered per year. We must, therefore, look to other geological or geophysical explorations or augment the seismic activities.

In order to evaluate our chances for meeting our reserve problem, we may consider the present means and methods available to us. It has been stated often that the time is ripe for the introduction of some entirely new method for the location of oil. Unfortunately, we can be reasonably certain that in the foreseeable future no such easy means is to be at hand. For geophysical exploration we will continue to rely chiefly on seismic methods, both reflection and refraction, on gravity methods to a lesser extent than in the past, and to a still lesser degree on magnetic prospecting. While electrical prospecting has received some slight impetus recently, there is no reason, from a careful analysis and consideration of this method, to expect any improvements which will materially affect the exploration for new reserves.

Improvements in Prospecting

The enormous experimentation and development of electronics during the war has in no manner changed the fundamental concepts and application of the known geophysical methods. However, these methods have been adapted for use under any surficial conditions in a far more efficient way than in the past. Seismic work is now carried out in swamps, on the water, in rough terrain, with much greater facility than heretofore. The gravity meter has also taken to the air and to the water, with transportation by helicopter and by ship. The magnetometer, formerly utilized only on the surface by manual operation, is now being airborne for rapid reconnaissance of inaccessible areas, and waterborne for analysis of undersea structures. Seismic resolving powers have been improved to permit the delineation of complex structures, and refraction techniques have been improved to uncover structures in areas previously found unsatisfactory for application of the seismic reflection method.

War and postwar developments in the field of electronics have provided for geophysical exploration various surveying devices which facilitate location on water, in jungle, and over other terrain conditions difficult to survey. We have, therefore, improved the general efficiency of each of the geophysical methods, but have in no wise changed their fundamental principles. There are still many areas in which the seismic reflection method cannot secure satisfactory results. Many of such areas offer extremely attractive possibilities for the development of oil reserves and cannot be suitably delineated by any other method. Portions of Illinois and Indiana, a large portion of the Michigan Basin, certain parts of Wyoming, much of northwestern Kansas, parts of Western Oklahoma, and certain areas of Texas, such as the Panhandle district and the Edwards Plateau, are still to be satisfactorily mapped by the seismic reflection method.

There have been some advances made in the securing of adequate results in these areas, but the seismologists could contribute greatly to the exploration possibilities if such large areas can finally be mapped suitably. You may be certain that the seismic industry, through its research facilities, is doing everything possible to open vast areas of this type to satisfactory exploration.

In the field of geology many new techniques for the study of subsurface formations have been developed and are being used intelligently. Careful analysis of electric logs, gamma ray and neutron logs, together with core analysis, sidewall sampling, and other such devices, have opened new lines of thought to resourceful geologists. The application of aerogeology in the study of large and relatively inaccessible areas has provided a rapid means of surface geologic-evaluation of potential oil producing provinces.

However, the greatest single factor, upon which depends the success and the degree and rate of success in the finding of new oil reserves, is the petroleum geologist. It is his resourcefulness, his controlled imagination, and his salesmanship to his company executives upon which hangs the ultimate fate of our supply problem.

The geophysical instruments and methods, the geological tools, the subsurface instruments, are merely factfinding devices which provide the information that he must correlate, interpret, and with imagination decide upon the areas to prospect and to drill. He must and will eliminate ancient prejudices and strike out into new territory with optimism and new and sound theoretical concepts. Experience will count, and it is to be hoped that the men now used in administrative capacities will be allowed time for new geologic thinking.

A study of the geologic map of the U. S. and an analysis of the intensity with which various types of exploration have been applied in these areas reveals that there are still vast potentially productive areas which have been relatively unexplored. The search will continue in the presently producing oil areas, where pipe lines are conveniently located, and where new thinking, detailed geophysical work, and careful application of all methods will discover new oil. For relatively remote areas, the Rocky Mountain region and its intermontane basins present attractive possibilities in an area which, compared to the intense application of all exploration methods, such as in the Mid-Continent, seems almost virgin territory.

Good Hunting Grounds Left

The great Anadarko Basin with production only on its periphery is relatively unexplored. The Dakotas and Western Nebraska, though condemned to date, will be reappraised. Much of west and southwest Texas still offers large promise. The real bonanza of reserves awaiting discovery lies in offshore areas of the Gulf Coast. It seems entirely reasonable to visualize as many fields lying within 50 miles offshore under water cover as have been found in a 50-mile belt in from the shore on the Gulf.

In this water covered area one seismic crew can many, many times over find its yearly quota of 5 million barrels of oil.

To draw further upon our controlled imaginations, consider how fast we could have found reserves in the Gulf Coast area had the present seismic techniques been available 30 years ago. Such a delectable prospect is now available to us on the Continental Shelf.

I have named only a few of the areas which need and will receive accelerated exploration. We can conservatively conclude, I believe, that we have the areas available in which to capture our reserves.

Given the areas to prospect, the improved tools of geologic fact finding, and the resourceful, intelligent, and imaginative application of these tools by the petroleum geologist, what must our oil industry do to solve the problem which it faces? First, our geologists must more completely familiarize themselves with the new fact finding tools available and with the results therefrom. Studies must be made of reservoir conditions in old areas as well as in some of the new, so that pools located largely on porosity may be discovered. Stratigraphers must come more into their own and be encouraged to carry on their studies of the present stratigraphic traps and paleogeography so that areas of stratigraphic production may be extended or predicted in advance. More geologists

must familiarize themselves with geophysical methods, particularly the seismic, so that in the new areas of complex structure their geological thinking may result in proper interpretation of structure. They must utilize more fully the stratigraphic information provided by the reflection seismograph for guidance to stratigraphic accumulations of oil. These geologists must shed any prejudices they may have had of unfavorable conditions and utilize their ingenuity and resourcefulness so that we may have new discovery thinking.

The geophysicists must improve their techniques so that large areas, as described above, which have fine potential possibilities, can be opened to proper structural evaluation.

We must intensify our campaign of exploration! We must have more geologists, more seismic crews, more exploration. We have adequate evidence in the curve which I have shown to you that increased exploration activity, despite the fact that we have found most large fields in the present oil producing areas, has provided sufficient reserves to more than meet the present demand.

While materials may be available to carry out preliminary geologic exploration, it is vitally necessary that the industry receive sufficient steel to block out these reserves by exploratory drilling and, finally, development. We must have government cooperation and not government hindrance, in order that this vast program may go on. At a time when the discovery of oil reserves is our paramount consideration, since in the eventuality of war, the very existence of our country will depend upon a more than adequate supply of petroleum, why must government agencies suggest such handicaps as the capitalization of geological and geophysical expense which, if instituted, would seriously retard the exploration effort? Why, when we have the vast protenially rich province off the shores of Texas and Louisiana, must our oil companies bear the uncertainty of title to their properties when, given a green light, we could in a short time unlock more of our liquid gold there than in any other area in the continental U. S.? I repeat, we must have government cooperation—not control or hindrance.

It is beyond the realm of doubt that our oil companies, our private individuals under this system of private enterprise which we value so highly, can, if unimpeded by governmental harassment or material shortages, meet the challenge of the future and find a sufficient domestic supply of oil to meet our short term needs.

But the handwriting is on the wall! At some future date . . . which no man can prophesy . . . we may be unable to balance our demand with the results of our domestic oil finding. It is also readily evident that in the field of exploration alone the cost of finding a barrel of oil is rapidly increasing. The intensification of the exploration program, the greater inaccessibility of areas prospected, the diminishing size of each field found, and the greater depths involved are some of the factors causing this increase. We know also that an individual oil company producing 100,000 barrels a day is hard pressed to find replacements for the 36½ million barrels produced per year, plus sufficient overage to encompass expanded requirements.

We must, therefore, look beyond the borders of the United States increasingly in the future for our supply of oil. In the discovery phase of the search for foreign oil, the unit cost of exploration is higher, but the unit results of oil found are far in excess of our present domestic results. If we assume that the assignment of 5 million barrels per year to a domestic seismic crew is large, we can rest assured that one seismic crew year in many foreign areas will result in hundreds of millions of barrels of discovered oil. This is particularly true of the Middle East.

World Demand Rising

The world demand for oil is rising as rapidly as our own. The Western Hemisphere, by proper exploration and development, can satisfy its own oil requirements for many years to come.

If permitted to do so by fair treatment, by adequate return for this know-how and the risk capital to be expended, by fairness and adherence to contractual agreements, with no changes and no retroactive arrangements, in short, if the American oil industry be permitted to operate in foreign lands under the same rights and privileges that we afford foreign nationals operating within the U. S., we could secure adequate oil for the defense of our Western Hemisphere and together benefit from the improved way of life which adequate petroleum provides for us.

The vital force of our American oil industry—unleashed—assures us of a domestic supply to meet our demands for the short term view. Suitable, fair, and friendly cooperation with our friends and neighbors of the Western Hemisphere beyond our borders will result in enough oil for long term future requirements for all and accrue to all the extraordinary benefits with which petroleum and its products endow mankind.

Permian Basin

■ CONTINUED FROM PAGE 60

came assured. Mid-Continent made northwest and southwest offsets to its discovery on 160- and 320-acre leases, respectively. Magnolia is drilling ½ mile due east on Santa Fe-Pacific 1-C, being ½ mile south of its original site that was selected on geophysical interpretations. Skelly Oil Company's Sawyer 1, C NE NE 33-9s-36e, 5/6 mile west by south of the discovery, and on a 160-acre lease, was spudded May 19 to forestall lease expiration due May 23.

The Santa Fe Railway is one of the largest fee owners in the immediate area. The firm reserved leases on a quarter or a half of each section and is in position to command substantial cash bonuses when development deals are made. New Mexico's unleased state lands in the area were promptly offered for lease on a public auction basis.

Development of the Devonian zone is tentatively scheduled to be on an 80-acre pattern until it is determined if the flowing life and crude yield per acre warrants the drilling of wells on the 40-acre spacing generally adhered to in New Mexico fields. The discovery did not encounter formation water in penetrating the Devonian beds 152 feet so it remains for future wells to determine if additional effective pay is present. The Jones Ranch field has one well producing at 225 feet in the Devonian without water, while the field's discovery was completed at 241 feet in the formation from 3 zones of perforations, with 26 percent water. However, the water was excluded when plugged back 52 feet.

Devonian formation has become within the past several years a major source of sweet and semi-sweet crude in the West Texas sector of the Permian Basin. It was considered unworthy of a production test and passed up by numerous deep explorations in the basin prior to August, 1944. Devonian producing areas uncovered following the initial strike in the Crossett field, centering upon the Crane-Upton County line, have not been on production for a sufficient period for valuation engineers to accurately forecast the crude yield per acre. Such is particularly true in the central and south sector of the basin where the formation is predominantly cherty-lime beds.

Mid-Continent's discovery has 100 feet of exposed pay in the dolomite. Using an arbitrary figure of 100 barrels of recoverable oil per acre foot as the minimum, this section would yield 10,000 barrels per acre, or 800,000 barrels per well on an 80-acre spacing pattern. Such a rate of recovery can be termed necessary for profitable operations since there will be the inevitable small producers and dry holes as development advances to the borders of the structure.

FOUR STEPS TO RELIEVE Steel Shortage

OIL AND GAS companies and steel companies, working together under the Taft anti-inflation act, can satisfactorily solve the problem of securing sufficient steel products to assure adequate oil supplies. Steel companies can help greatly by adopting sales and distribution methods that will prevent "gray markets" and hoarding of steel goods, by fully utilizing capacity for making oil industry steel products, and by keeping that capacity fully abreast of the steadily increasing demand for petroleum.

A PROGRAM to ease the shortage of steel supplies for the petroleum and natural gas producing industries has been outlined by Russell B. Brown, general counsel of the Independent Petroleum Association of America. In addressing the Ohio Oil and Gas Association, Brown suggested a four-point program which could be put into effect by the steel industry under provisions of the Taft Anti-Inflation Act authorizing cooperative industry action under government approval. The essentials of the program are:

1. Voluntary allocation of enough steel to maintain all pipe-making facilities at full capacity.

2. Voluntary adoption of methods of sale and distribution that would eradicate "gray markets."

3. Voluntary adoption of methods of distribution that would make supplies of material available only for those who certify that such goods are for immediate use and not for storage or resale at premium prices.

4. Voluntary establishment of emergency stocks of materials for priority delivery to operators requiring such materials for completion of successful exploratory wells.

Lack of Tubular Goods

For more than a year, Brown said, a major point in the program of IPAA has been the alleviation of the lack of tubular goods which is preventing the drilling of wells in sufficient number to increase available reserves of crude oil "to a point consistent with daily needs and to assure a reserve producing capacity to meet possible emergency demands." During the war years, he said, artificial governmental restrictions prevented the drilling of more than 70,000 wells which would have been necessary to carry out the normal trend of development.

IPAA statistics show that a total footage of 113 million feet was drilled during 1947, an increase of 11 percent over the 101 million feet drilled in 1946. Production of oil country tubular goods has been increased from 1,095,000 tons in 1946 to an estimated rate of production of 1,600,000 tons for the current year, an increase of 46 percent over the volume produced two years ago.

A recent resolution adopted by the independent producers' association set forth five principles as a basis for relieving the current steel-oil shortage:

"1. The supply of oil country tubular goods and lease equipment for the domestic petroleum industry must be increased in relation to the continuing longterm upward trend in the demand for petroleum products. It is incumbent on the steel industry to recognize these trends and in addition to maintaining the necessary production of materials for current needs, to anticipate and plan for the increased requirements for these materials in the future.

"2. To attain the safe margin of productive capacity based on adequate petroleum reserves which characterized this industry prior to World War II, it is essential that the necessary amount of vital materials for development of our domestic petroleum resources be made available for use in this country. Constant and vigilant scrutiny of the exportation of these materials must be maintained. Up to this time export policies have been administered in disregard of the welfare of the domestic industry.

Encouragement of Exploration

"3. The discovery of additional reserves of petroleum is of primary concern to the industry and the Nation and can be accomplished only by intensive exploratory effort. To encourage this effort some of the suppliers of oil country tubular goods have set up emergency stocks available for completion of productive exploratory wells. This practice is commendable and should be adopted by all suppliers as it will result in increased exploratory effort with a minimum amount of steel.

"4. Methods of distribution of oil country goods must be corrected. The practices of some suppliers and users have created inequities and gray markets that threaten to bring about government control of the allocation of these materials. This association believes that private industry, if it has the determination to do so, can correct these distribution problems more effectively than government.

"5. The most efficient use of the available materials to obtain the maximum producing capacity depends on a careful study of casing programs and well-spacing patterns. This should be given full consideration by the petroleum industry and state regulatory bodies."

The shortage of steel for pipe in the gas utility industry is the worst in its 100-year history, according to a report recently issued by the American Gas Association. The survey, results of which were presented to the Oil and Gas Division of the Department of Interior, indicates that prompt relief must be forthcoming or there will be serious disruption to both the domestic and industrial life of the nation.

Steel Needed for Gas Utilities

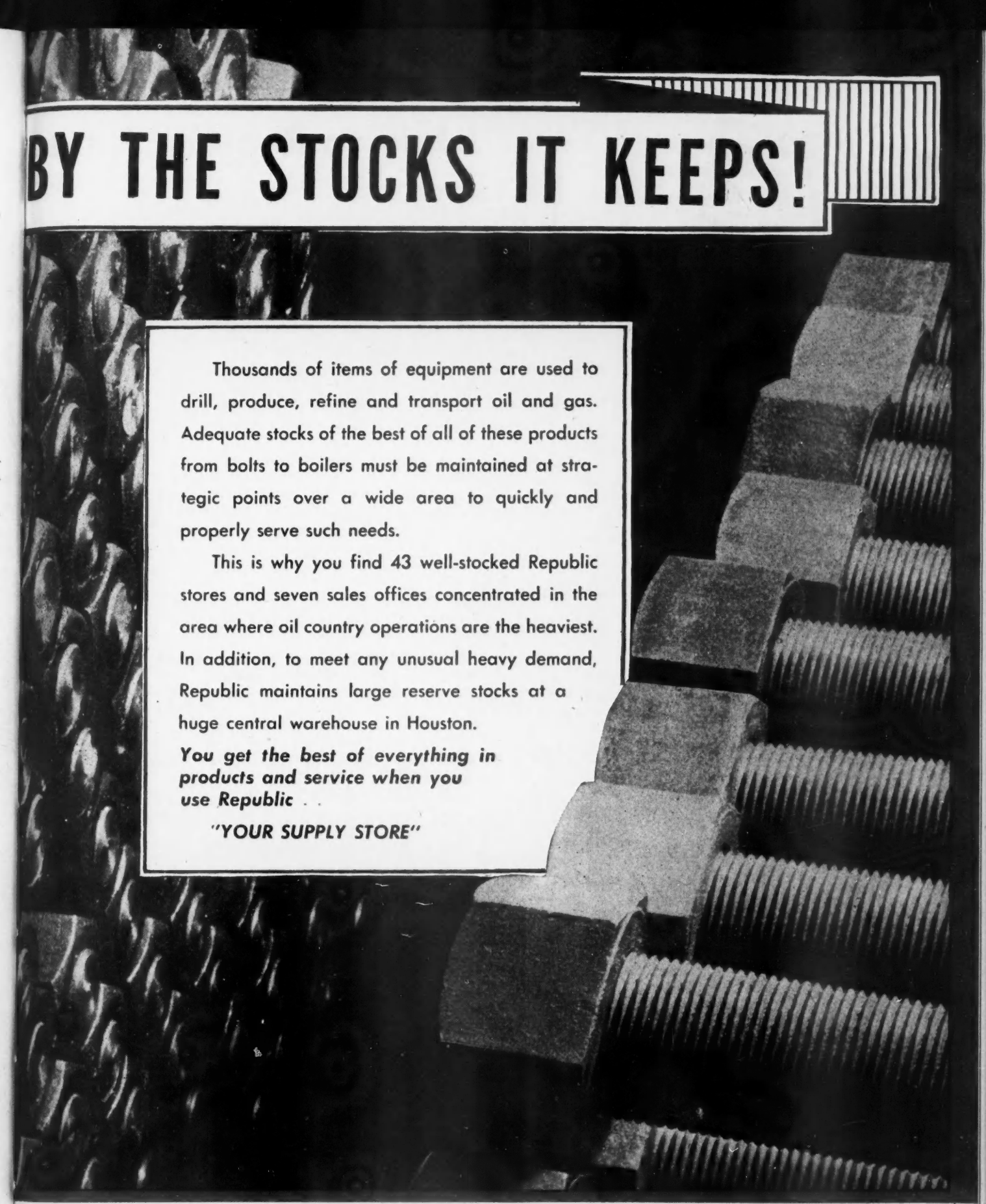
Gas utilities, says the study, must receive a minimum of 805,900 tons of steel for essential needs before September 30, 1949. This amount is in excess of the estimated 2,217,400 tons for steel pipe required for the same period.

AGA says that without the steel, operations of 1,396,000 hospitals and commercial establishments will be hampered to an alarming degree.

The Department of Commerce announced June 24 that it will not seek voluntary allocations of steel for the oil industry for oil country goods and line pipe. The department's Office of Industry Cooperation pointed out that the industry's oil country goods requirements were in excess of projected production and, at any rate, entire output is now going to the oil and gas industries. Allocation of line pipe would not be practical, the agency said, because the oil industry's stated requirements are higher than possible production.

Study will be given later to the suggestion of limiting inventories of oil country goods.

BY THE STOCKS IT KEEPS!



Thousands of items of equipment are used to drill, produce, refine and transport oil and gas. Adequate stocks of the best of all of these products from bolts to boilers must be maintained at strategic points over a wide area to quickly and properly serve such needs.

This is why you find 43 well-stocked Republic stores and seven sales offices concentrated in the area where oil country operations are the heaviest. In addition, to meet any unusual heavy demand, Republic maintains large reserve stocks at a huge central warehouse in Houston.

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REPUBLIC STEEL

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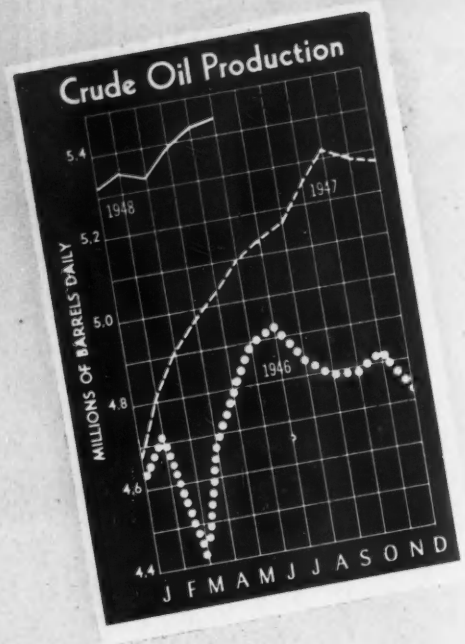
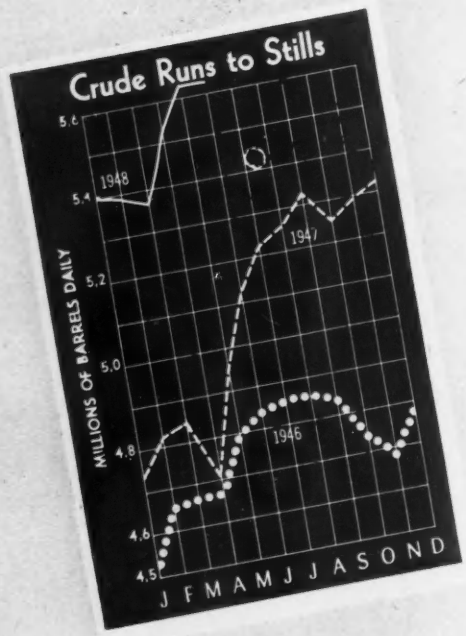
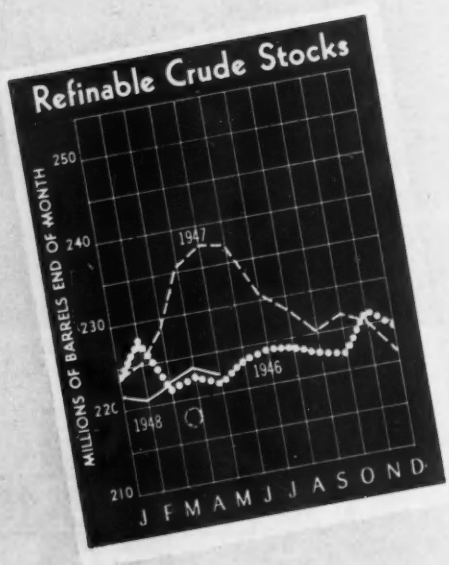
July to Replace June

By CECIL SMITH,







THE industry's producers and refiners continued to push their operations upward during June to make it the most active month in history. Again new all-time records were set in crude oil production, crude refining, and gasoline manufacture, but as has been the case for over a year, these records will stand only until figures are available for the succeeding month which will show even higher levels. Despite the record amount of crude oil put through refineries, crude stocks were able to show some improvement for the first time in several months. However, stocks of the major refined products follow more definite seasonal trends and during June these were adhered to faithfully. As the summer season was getting well under way, the accompanying heavier motoring and agricultural needs made heavy withdrawals from gasoline stocks necessary, while fuel oil stocks made satisfactory headway.

U. S. daily crude oil production averaged 5,486,000 barrels during June, a new high mark for the industry. This was an increase of 52,000 barrels daily over output in May and 387,000 daily over that produced in June of last year. Although June's average was a new high, it was only slightly higher than the previous record of 5,484,000 barrels daily in April of this year. For the first six months of this year crude production has averaged 5,407,000 barrels daily against 4,916,000 daily in the same period of 1947, a gain of about 10 percent.

Refiners operated their facilities at over 96 percent of rated capacity in order to process the record amount of 5,644,000 barrels per day during

Crude Oil and Refined Products Trends
(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		DIST'LLATE FUEL		RESIDU'AL FUEL	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month
1945:									
January	4,756	4,680	221,737	2,094	91,666	663	31,695	1,350	44,347
February	4,767	4,817	220,221	2,194	97,457	724	27,210	1,326	39,760
March	4,804	4,719	223,988	2,124	97,447	675	26,729	1,273	35,451
April	4,807	4,774	224,229	2,127	90,804	681	29,148	1,289	34,418
May	4,887	4,913	223,151	2,179	88,530	708	29,511	1,341	34,333
June	4,859	4,989	218,218	2,166	86,128	730	32,440	1,351	35,606
July	4,897	5,001	216,638	2,281	85,582	713	36,276	1,351	38,341
August	4,870	4,928	215,135	2,269	84,003	701	41,245	1,329	42,227
September	4,423	4,275	220,319	1,933	74,574	640	45,059	1,139	42,822
October	4,284	4,244	221,246	1,888	76,805	613	45,479	1,176	42,368
November	4,517	4,624	218,916	2,156	86,540	665	44,562	1,265	41,322
December	4,472	4,574	218,763	2,056	97,676	683	35,778	1,245	37,158
1946:									
January	4,625	4,520	223,442	1,914	102,394	787	28,990	1,224	34,573
February	4,719	4,651	227,220	1,884	104,836	823	25,511	1,243	34,008
March	4,414	4,661	221,400	1,900	104,161	816	29,922	1,213	32,995
April	4,673	4,663	222,480	1,943	98,744	773	32,064	1,247	35,206
May	4,785	4,794	221,592	2,016	93,960	753	33,385	1,220	38,932
June	4,896	4,836	223,140	2,055	91,971	777	38,824	1,219	41,492
July	4,922	4,856	224,351	2,102	87,778	793	46,439	1,163	45,446
August	4,836	4,856	224,157	2,189	86,745	765	54,068	1,159	48,186
September	4,790	4,839	222,417	2,143	87,021	796	62,019	1,150	54,012
October	4,785	4,736	222,177	2,117	85,952	788	76,780	1,090	55,580
November	4,823	4,684	226,453	2,162	88,587	791	68,145	1,101	52,735
December	4,725	4,780	224,473	2,168	92,742	805	59,912	1,159	47,094
1947:									
January	4,671	4,739	223,848	2,078	99,623	778	48,197	1,174	41,550
February	4,810	4,820	225,121	2,089	103,672	777	36,901	1,228	48,480
March	4,908	4,843	228,981	2,076	105,679	825	31,423	1,222	37,403
April	4,974	4,707	235,710	2,037	101,724	764	30,268	1,148	36,455
May	5,033	4,947	237,768	2,128	95,209	805	34,279	1,204	39,992
June	5,099	5,120	237,278	2,258	89,774	807	39,676	1,233	43,515
July	5,137	5,221	230,974	2,302	86,003	847	46,444	1,244	47,600
August	5,173	5,260	228,523	2,383	85,849	869	54,707	1,245	51,334
September	5,251	5,236	225,258	2,375	84,360	911	59,764	1,237	52,578
October	5,320	5,253	226,666	2,371	82,584	938	63,252	1,260	52,502
November	5,291	5,291	225,462	2,332	87,551	942	61,334	1,245	52,455
December	5,337	5,350	224,929	2,347	92,303	992	51,081	1,282	47,091
1948:									
January	5,283	5,348	223,430	2,328	102,167	1,082	41,036	1,278	44,636
February	5,353	5,380	224,880	2,264	110,999	1,127	34,590	1,295	43,156
March	5,406	5,387	227,408	2,252	111,949	1,050	39,214	1,307	41,945
April	5,484	5,540	227,278	2,396	109,829	978	34,514	1,303	43,301
May	5,434	5,640	221,698	2,472	107,212	1,005	39,333	1,324	48,100
June	5,486	5,644	223,011	2,550	104,145	1,013	46,521	1,288	52,470
June, 1948 Change:									
In Month	+52	+4	+1,313	+78	—3,067	+8	+7,188	—36	+4,370
In One Year	+387	+524	—14,267	+292	+14,371	+206	+6,845	+55	+8,955
In Two Years	+590	+808	—129	+495	+12,174	+236	+7,697	+69	+10,978

Trends

As Most Active Month

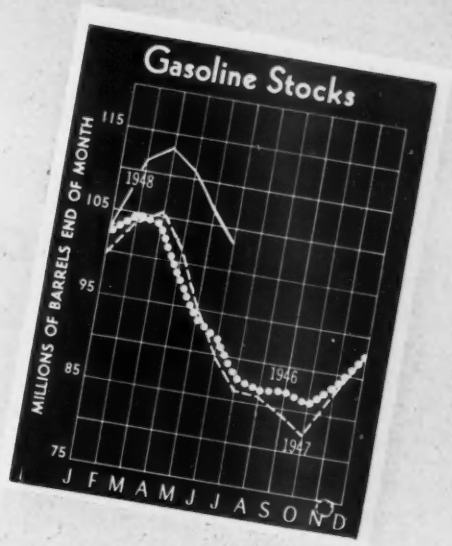
Staff Writer

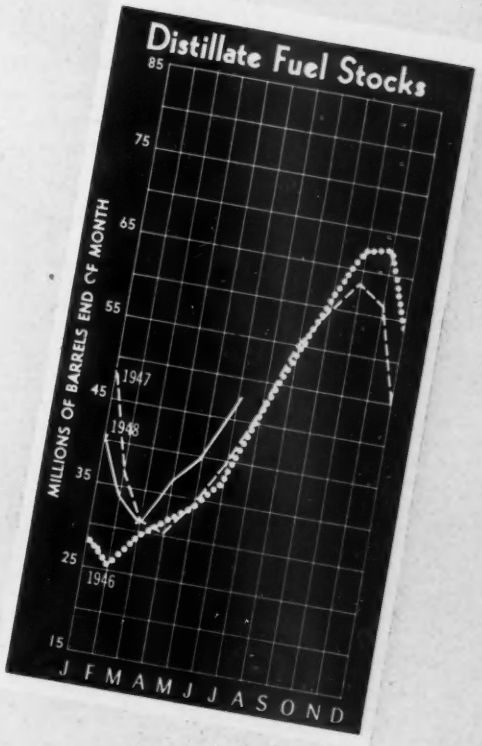
June. That was 4000 barrels a day over the previous peak of May, 1948, and 524,000 daily over refinery runs of June, 1947. A year ago the nation's refineries were operating at about 91 percent of capacity and that was then considered very high and practically impossible to maintain for any period of length. However, since then this rate of operation has continued to increase and has at times reached a high of 99 percent for short periods.

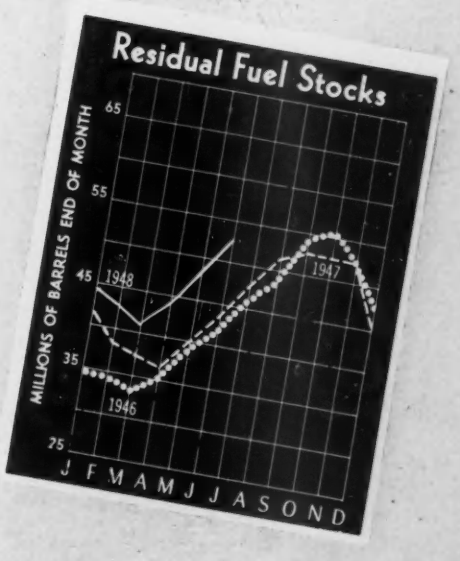
Some improvement in refinable crude oil stocks occurred during June, when they gained 1,313,000 barrels to reach 223,011,000 barrels by the end of the month. However, stocks of this material are not in a very favorable position when compared with stocks of previous years. A year ago they totaled 237,278,000 barrels or 14,267,000 barrels more than current stocks. At the middle of 1941, there were 47,395,000 barrels more in storage tanks.

Output of gasoline averaged 2,550,000 barrels daily during the month to set a new production record. This was an increase of 78,000 barrels daily over May's peak and 292,000 barrels daily over production in June, 1947. Even with production at all-time levels it could not take care of demand and as a result stocks of finished and unfinished gasoline were lowered 3,067,000 barrels to end the month at 104,145,000 barrels. These stocks were 14,371,000 barrels greater than the 89,774,000 barrels on hand at the end of June of last year. Even with this more favorable stocks position, there still remains the possibility of spot shortages of gasoline in localized areas later in the summer. These do not promise to be very serious or longlasting and will result from lack of local refining capacity and inadequate transportation facilities. The American Petroleum Institute has recently said, "With a fair degree of luck and a reasonable amount of conservation on the part of the public, chances of serious shortages of petroleum products in 1948 are materially lessened."

Stocks of the fuel oils continued to build satisfactorily during June and are now substantially ahead of last year's schedule.







State Crude Oil Production

(THOUSANDS OF BARRELS)

STATE OR DISTRICT	DAILY AVERAGE PRODUCTION				TOTAL FIRST SIX MONTHS		
	June, 1948	May, 1948	June, 1947	% Diff. June, '47-'48	1948	1947	% Diff. '47-'48
Alabama	1 4	1.4	1.1	+27.3	233	181	+28.7
Arkansas	82.6	83.0	80.8	+ 2.2	15,442	14,560	+ 6.1
California	951.2	947.1	914.2	+ 4.0	171,272	163,552	+ 4.7
Colorado	47.1	47.5	42.1	+11.9	8,330	7,044	+18.3
Florida	0.8	0.7	1.0	—20.0	142	99	+43.4
Illinois	172.6	172.8	178.2	— 3.1	31,431	33,654	— 6.6
Indiana	20.0	20.7	16.7	+19.8	3,027	3,089	— 1.7
Kansas	303.5	299.5	291.6	+ 4.1	53,297	50,928	+ 4.7
Kentucky	24.1	25.3	25.1	— 4.0	4,344	4.573	— 5.0
Louisiana	469.2	466.3	431.5	+ 8.7	86,395	76,880	+12.4
North Louisiana	113.9	111.6	96.4	+17.1	20,768	17,632	+17.8
South Louisiana	356.3	354.7	335.1	+ 6.3	65,627	59,248	+10.8
Michigan	44.3	44.9	43.2	+ 2.5	8,182	7.744	+ 5.7
Mississippi	121.6	123.0	94.4	+28.8	21,789	16,001	+36 2
Missouri	0.1	0.1	0.2	—50.0	26	26	.....
Montana	25.3	23.2	23.9	+ 5.9	4,415	4,173	+ 5.8
Nebraska	0.4	0.5	0.6	—33.3	102	111	— 8.1
New Mexico	128.2	126.6	108.3	+18.4	23,268	19,183	+21.3
New York	14.2	13.7	13.3	+ 6.8	2,373	2,347	+ 1.1
Ohio	10.2	9.8	8.8	+15.9	1,651	1,467	+12.5
Oklahoma	426.9	419.8	378.8	+12.7	74,729	67,950	+10.0
Pennsylvania	33.9	33.9	35.3	— 4.0	6,255	6,254	.....
Tennessee	.....	.....	.....	.....	3	4	—25.0
Texas	2,455.3	2,421.1	2,283.8	+ 7.5	440,100	388,022	+13.4
Dist. 1—South Central	28.6	26.9	21.7	+31.8	4 793	3,711	+29.2
Dist. 2—Middle Gulf	173.7	172.0	166.6	+ 4.3	31,196	27,757	+12.4
Dist. 3—Upper Gulf	497.6	493.1	494.5	+ 0.6	90,083	84,762	+ 6 3
Dist. 4—Lower Gulf-S.W.	256.4	255.6	247.7	+ 3.5	46,378	42,357	+ 9.5
Dist. 5—East Central	47.0	46.4	40.0	+17.5	8,226	6,780	+21 3
Dist. 6—Northeast	433.9	425.8	450.1	— 3.6	78,688	78,540	+ 0.2
Dist. 7-B—North Central	48.3	45.2	39.5	+22.3	8,159	6,670	+22.3
Dist. 7-C—West Central	46.0	45.0	39.0	+17.9	8,081	6,242	+29.5
Dist. 8—West	697.6	688.0	560.7	+24.4	122,974	90,015	+36.6
Dist. 9—North	139.9	138.5	141.5	— 1.1	25,453	23,809	+ 6 9
Dist. 10—Panhandle	86.3	84.6	87.7	— 1.6	15,680	15,341	+ 2.2
Virginia	0.2	0 2	0.2	.....	26	44	—40.9
West Virginia	7.4	7.9	7.0	+ 5.7	1,339	1,252	+ 6.9
Wyoming	145.4	144.9	119.2	+22.0	25,958	20,745	+25.1
Total United States	5,485.9	5,433.9	5,099.3	+ 7.6	984,139	889.883	+10.6

Completions

May Exceed 38,000 Wells

AS DEMAND for crude oil continues to rise, the U. S. industry is drilling more wells this year than ever before and many more than expected tubular supplies would have permitted. At the beginning of the year oil company reports on drilling plans and steel mill reports on future availability of tubular goods indicated that the year's total new wells could not quite reach the 35,000 mark. However, with six months actual experience on which to base a revised estimate, it appears almost certain that at least 38,000 new wells will have been completed by the end of the year.

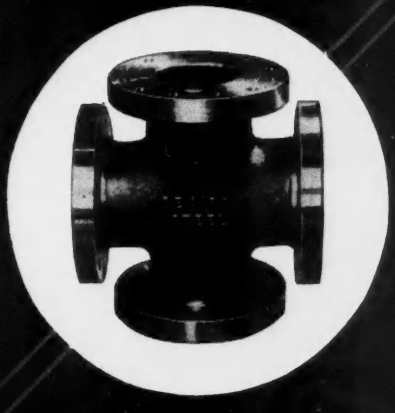
Since the original drilling forecasts were made at the first of the year, several factors have worked towards stepping up the program. First of all, estimates of availability of tubular supplies have thus far proved to have been on the conservative side and these supplies were considered the limiting factor. They have been and will continue for some time to be most influential on drilling, but so far this year the steel industry has been able to furnish more pipe than it could or would dare promise earlier.

Also playing an important part in the activity increase are higher crude prices. At the start of the year a substantial price increase was made. Coming when it did, its full effect could not be foreseen and incorporated into drilling estimates, but this hike alone has been responsible for the drilling of extra wells. Newcomers who could scrape up pipe have been attracted to the drilling game. Companies which would have conserved their precious tubular stocks have been willing to narrow these stocks for the sake of increased present production. Some operators have even resorted to the extreme practice of having casing rolled from steel plate, a costly operation but desirable for increasing production and justifiable and possible only by current crude prices. Should more pipe become available or another price hike occur in the next six months, the end of the year might find that the new estimate of 38,000 wells was too conservative.

Well Completions in the United States During June, 1948, and Cumulative for Year

(Figures compiled by WORLD OIL Staff from private reports and other sources as follows: Illinois from Illinois Geological Survey; Indiana from Indiana Division of Geology; Missouri from Missouri Geological Survey; Tennessee from Tennessee Division of Geology; Bradford, Kane-Clarendon, and Allegany fields of Pennsylvania and New York from the Producers' Monthly.)

STATE OR DISTRICT	MONTHLY COMPLETIONS, JUNE, 1948													CUMULATIVE TOTAL January-June				Rigs in Operation (Drilling, Rigging Up and Shut Down)		
	New Wells									Total Completions										
	Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Total New	Total Drilled Deeper	June, 1948	May, 1948	June, 1947	Footage June, 1948	Wells 1948	Wells 1947	Percent Diff.	Footage, 1948	June 30 1948	May 31, 1948	June 30 1947
Alabama				2				2		2	2	2	6,616	8	9	− 11.1	36,177	3	4	7
Arizona				1				1		1			630	1			630	6	7	2
Arkansas	7	1	2	15				25		25	22	19	98,381	139	120	+ 15.8	557,993	49	39	40
California	212		3	37				252	6	258	213	147	893,399	1,275	934	+ 36.5	4,488,709	282	280	266
Colorado	13			6				19	1	20	18	16	93,501	124	79	+ 57.0	677,018	52	54	62
Florida				2				2		2	2	4	3,130	12	17	− 29.4	73,140	7	4	6
Georgia														2	1	+100.0	8,871			2
Illinois	131		2	102				235		235	238	167	579,619	1,029	902	+ 14.1	2,629,239	241	253	229
Indiana	39			66			1	106		106	104	63	207,375	486	255	+ 90.6	896,563	111	106	70
Kansas	166		53	109			4	332		332	284	190	1,084,245	1,409	1,121	+ 25.7	4,628,620	266	285	297
Kentucky	23		24	31				78		78	68	82	147,582	358	395	− 9.4	719,492	80	84	127
Louisiana	139	8	13	53			2	215	1	216	200	116	1,177,447	1,024	623	+ 64.4	5,161,944	226	233	190
North Louisiana	95	2	10	23			1	131	1	132	137	62	356,826	644	326	+ 97.5	1,722,818	73	79	67
South Louisiana	44	6	3	30			1	84		84	63	54	920,621	380	297	+ 27.9	3,439,126	153	154	123
Maryland														1			5,259			
Michigan	31			34				65		65	53	69	140,687	311	278	+ 11.9	720,707	117	127	110
Mississippi	24	3	1	6				34		34	36	54	261,624	193	213	− 9.4	1,579,131	56	52	91
Missouri											5	3		26	26		9,442	8	5	4
Montana	13		1	6				20	1	21	32	23	42,722	141	73	+ 93.2	353,500	48	48	64
Nebraska														1			4,965	2		6
Nevada																		1	1	
New Mexico	42	1	6	10				59	7	66	43	52	257,534	324	288	+ 12.5	1,304,404	109	130	126
New York	98		1	1	63			163		163	135	158	229,294	852	796	+ 7.0	1,249,700	207	168	196
North Carolina															1	−100.0				
Ohio	33		35	46				114	7	121	124	110	278,379	625	629	− 0.6	1,597,793	212	216	244
Oklahoma	181		15	127		2		325	8	333	337	337	1,233,657	1,918	1,791	+ 7.1	1,724,506	565	580	503
Oregon												1			1	−100.0				
Pennsylvania	115		37	16	108	16		292	4	296	268	280	512,221	1,594	1,608	− 0.9	2,773,775	435	396	396
South Dakota														1			1,365			
Tennessee	1			6				7		7	7	1	11,481	28	9	+211.1	40,783	20	20	7
Texas	579	17	26	347				969	15	984	917	815	4,236,712	5,555	4,310	+ 28.9	23,698,301	1,452	1,446	1,277
Dist 1—S. Central	12	1		16				29		29	33	21	108,329	232	148	+ 56.8	739,300	46	47	34
Dist. 2—Middle Gulf	33	2		20				55	1	56	70	52	337,086	384	300	+ 28.0	2,219,301	69	59	58
Dist. 3—Upper Gulf	50	6	11	34				101		101	87	49	657,017	506	375	+ 34.9	3,348,124	126	137	98
Dist. 4—L. Gulf-S.W.	69	7	3	45				124	4	128	115	101	570,316	673	543	+ 23.9	3,262,890	125	112	109
Dist. 5—E. Central	15			10				25		25	18	19	128,989	100	63	+ 58.7	496,918	42	35	32
Dist. 6—Northeast	16	1	6	10				33	1	34	21	40	185,054	183	225	− 18.7	1,007,849	47	51	68
Dist. 7-B N. Central	55		6	62				123	1	124	99	76	398,766	635	388	+ 63.7	1,975,532	177	163	131
Dist. 7-C—W. Central	23			19				42	2	44	20	29	176,311	185	120	+ 54.2	716,118	75	88	73
Dist. 8—West	194			37				231	2	232	222	191	1,076,420	1,370	925	+ 48.1	6,206,062	479	490	386
Dist. 9—North	84			93				177	4	181	181	197	479,778	1,028	997	+ 3.1	2,873,896	111	104	172
Dist. 10—Panhandle	28			1				29		29	51	40	118,646	259	226	+ 14.6	852,311	155	160	116
Utah				3				3		3	1		5,062	12	3	+300.0	48,272	9	10	7
Virginia														1			2,301			
Washington				1				1		1			4,927	2			11,205		1	1
West Virginia	14		31	11				56	1	57	63	76	139,118	371	388	− 4.4	929,788	384	378	375
Wyoming	28			12				40	6	46	42	11	140,021	209	94	+122.3	810,186	142	140	97
Total United States	1,889	30	250	1,050	171	18	7	3,415	57	3,472	3,214	2,796	11,785,364	18,032	14,964	+ 20.5	61,733,779	5,090	5,067	4,802



EPENDABILITY . . . and long life

WITH BEAIRD-BUILT
PRECISION MADE
STEEL FITTINGS

Exploration

Up 27 Percent Over 1947

THE END of the first half of the year found the industry well on its way to make 1948 the banner year in exploratory drilling. Despite shortages of steel products, the nation's wildcatters have already completed over 27 percent more exploratory tests than they did in the same period of 1947, the year which holds the all-time drilling record. It takes little calculation to see that it is only a matter of six months before 1947 becomes the dethroned exploration champion.

Accounting for a large part of the half year's achievements was June, in which 597 wells were completed for the second highest mark in history. This record was topped only by 609 tests finaled in October of last year. But the worth of wildcat drilling still must be measured by the number of commercial producers gained and not by overall totals, and in this department June lagged slightly. A month earlier 542 ventures yielded 109 producing wells for a score of 20 percent, while June's 108 producers amounted to only 18 percent, which was less than the six months' average of 19.8.

Perhaps the most noteworthy test completed during the month was Richfield Oil Company's Cuyama Valley wildcat in California which opened a promising area in a part of the country that hasn't had a major strike in a number of years. A complete story about this discovery appears on page 87 of this issue.

Summary of Results of Exploratory Drilling

ITEM	June, 1948	May, 1948	Six Months: Jan.-June 1948	1947	Percent Diff.
Oil Discoveries	80	67	405	327	+ 23.9
New Fields	52	43	246	191	+ 28.8
New Pays	28	24	159	136	+ 16.9
Distillate Discoveries	7	9	45	44	+ 2.3
New Fields	6	7	24	19	+ 26.3
New Pays	1	2	21	25	— 16.0
Gas Discoveries	8	10	60	52	+ 15.4
New Fields	6	9	42	39	+ 7.7
New Pays	2	1	18	13	+ 38.5
Total Discoveries	95	86	510	423	+ 20.6
Extensions to Fields	13	23	93	62	+ 50.0
Oil Fields	11	19	74	48	+ 54.2
Distillate Fields	2	.....	8	7	+ 14.3
Gas Fields	.....	4	11	7	+ 57.1
Total Prod. Tests	108	109	603	485	+ 24.3
Dry Holes	489	433	2,435	1,904	+ 27.9
Wildcats	484	425	2,395	1,843	+ 30.0
New Pays	1	1	7	29	— 75.9
Outposts	4	7	33	32	+ 3.1
Total Exploratory Tests	597	542	3,038	2,389	+ 27.2
Percent Productive	18.1	20.1	19.8	20.3	.....
Percent Dry	81.9	79.9	80.2	79.7	.....

Results of Exploratory Drilling in June and First 6 Months, 1948-1947, By Districts

State or District	MONTH OF JUNE, 1948													FIRST SIX MONTHS, 1948															
	Productive Tests									Total Productive	Unproductive Tests			Total Exploratory Tests	Productive Tests								Total Productive		Unproductive Tests				Total Exploratory Tests	
	New Fields			New Pays			Extensions				Wildcats	New Pays	Outposts		New Fields			New Pays			Extensions						Total Dry			
	Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas						Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas	6 Mo. 1948	6 Mo. 1947				6 Mo. 1948	6 Mo. 1947	6 Mo. 1948	6 Mo. 1947
Alabama											2			2												8			8	6	8	6
Arizona											1			1												1			1		1	
Arkansas											12			12	2								2	5	44			44	26	46	31
California	5						3			8	23			31	9		1	6			12	1	1	30	9	108			108	130	138	139
Colorado								..			7			7										2	25			25	19	25	21
Florida											2			2											9			9	16	9	16
Georgia																									2			2	1	2	1
Illinois	3			3			1			7	46			53	12			14			14		40	64	209			209	168	249	232
Indiana	8						1			9	25			34	13		1	3			2		19	9	108			108	52	127	61
Kansas	7									7	49			56	34		1	2			1		38	33	217	1		218	156	256	189
Kentucky											7			7	1		1	1			1		4	4	24			24	32	28	36
Louisiana	2	3	2	6		1				14	22			36	4	8	4	27	6	2	2	3	56	41	107		1	108	105	164	146
N. Louisiana	2		1							3	10			13	3		2	1			2	2	10	7	51			51	63	61	70
S. Louisiana		3	1	6		1				11	12			23	1	8	2	26	6	2		1	46	34	56		1	57	42	103	76
Maryland																									1			1		1	
Michigan	1									1	18			19	5		3				1		9	9	110			110	91	119	100
Mississippi											4		1	5							2		2	5	40		1	41	38	43	43
Missouri																									3			3	9	3	9
Montana				1						1	2			3	1			1			1		3	1	15			15	5	18	6
New Mexico			1	1						2	4			6	6	1	1	4		1			13	5	30			30	28	43	33
North Carolina																													1		1
Ohio											3			3	1						1		9	1	18			18	26	27	27
Oklahoma	6		1	2			1			10	36			46	26	2	8	15			4		55	54	217		1	218	282	273	336
Oregon																													1		1
Pennsylvania											1			1											3			3	1	3	1
South Dakota																									1			1		1	
Tennessee											6			6	1								1		19			19	9	20	9
Texas	18	3	2	13	1	1	4	2		44	202	1	2	249	124	13	17	76	15	15	30	4	3	297	236	1036	6	28	1070	679	1367	915
Dist. 1 S. Central											14			14	1			1			1		3	7	89			89	61	92	68
Dist. 2 Middle Gulf	1			3	1			1		6	14			20	10	1	2	12	7	2	3	2	39	28	94	1	5	100	60	139	88
Dist. 3 Upper Gulf	3	1	1	5		1				11	22		1	34	9	4	1	26	2	3	3	1	2	51	42	125	1	3	129	71	180	113
Dist. 4 L. Gulf-S.W.	2	2	1	3				1	1	10	25		1	36	11	6	4	11	6	9	2	1		50	56	157	1	12	170	114	220	170
Dist. 5 E. Central											10			10	2			2			1		5	4	39			39	29	44	33
Dist. 6 Northeast							1			1	3	1		5	1	2		4			5		12	5	33	2		35	25	47	30
Dist. 7-B N. Central	6			1			1			8	43			51	38		7	10			2		57	34	187			187	115	244	149
Dist. 7-C W. Cent.	1			1						2	13			15	7			2			1		10	7	45			45	15	55	22
Dist. 8 West	5									5	17			22	24		2	3			6		1	36	20	81	1	4	86	63	122	83
Dist. 9 North							1			1	41			42	21		1	5			7			34	31	184		4	188	117	222	148
Dist. 10 Panhandle																								2	2			2	9	2	11
Utah											3			3				1					1		11			11	3	12	3
Virginia																		1					1							1	
Washington											1			1											2			2		2	
West Virginia																		2					2	1						2	1
Wyoming	2			2			1			5	8		1	14	7			1	10		3			21	6	27		2	29	20	50	26
Total U.S.	52	6	6	28	1	2	11	2		108	484	1	4	597	246	24	42	159	21	18	74	8	11	603	485	2395	7	33	2435	1904	3038	2389

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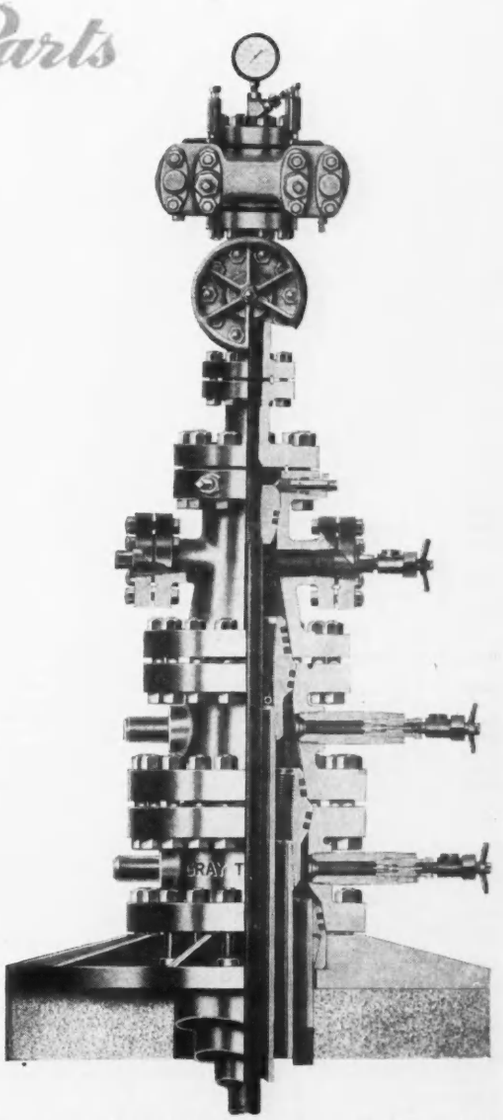

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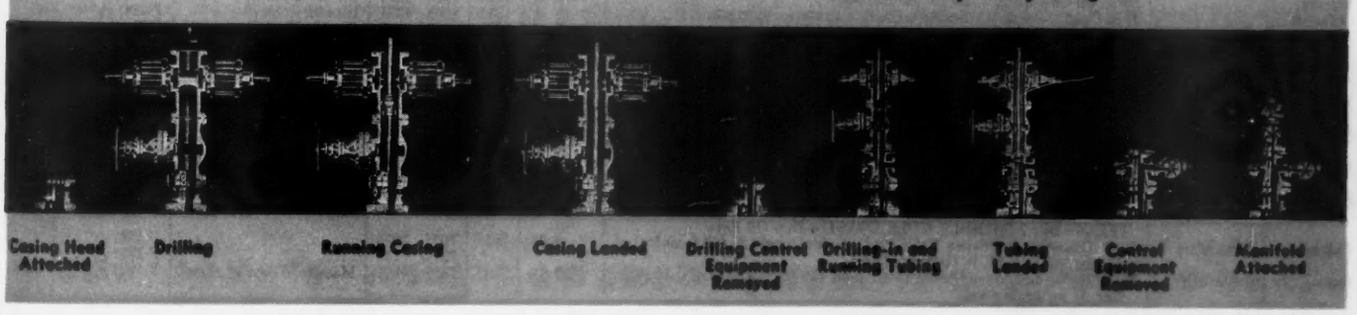

New Oil, Distillate and Gas Fields and New Pay Horizons Discovered in the United States in June, 1948
Also Important Extensions to Established Fields

COUNTY	FIELD	COMPANY, WELL AND LOCATION	Date Completed	Total Depth (Feet)	Completion Horizon (Feet)	[1]Name, Character and Age of Producing Formation	[2]Initial Production Method and Choke	Gravity of Oil
		CALIFORNIA—New Oil Fields						
Kern		Richfield Oil Corp's KCL—Coal Oil Canyon 72-29, 891 s, 812 w fr nec Sect 29-11n-20w, Wheeler Ridge Area.	5-19-48	1176	1000- 1150		P 126	23.4
Monterey		Jergins Oil & North American Cons' Orradre 15-12, 330 s&e fr w¼ cor Sect 12-23s-10e, 3½ mi se San Ardo fld.	6-14-48	2157	2082- 2156		P 250	13
San Luis Obispo		Continental Oil Co's LeRoy 2, 2997 n 981 e fr swc Sbdn. 162, Ranco Guadalupe, Sect 2-10n-36w.	6-21-48	2759	2680- 2740		P 50; 30 wtr	11
San Luis Obispo		Richfield Oil Corp's Anderson-Colgrove (1), 37-30, 1118 n, 1574 e fr sec Sect 30-11n-27w, 2½ mi nw Russell well. Cuyama Valley.	6-18-48	3022	2800- 3019	Miocene	F 1600	33.6
Santa Barbara		Richfield Oil Corp's Russell 1, 28-5, 380 n 1014 e fr swc Sect 5-10n-27w, 3 mi se Norris Oil Co's disc. Cuyama Valley.	6-13-48	4218	2970- 3360	Miocene	F 508; ¾"	38.3
		CALIFORNIA—Oil Field Extensions						
Fresno	Raisin City	K.R.D. Syndicate's Well 1, 200 s, 200 w fr cen Sect 10-15s-17e, ¾ mi ne extension.	6- 6-48	5227	4980- 4988	Shell gas sd	F 175; $\frac{1}{2}$"	24
Fresno	Coalinga, N.	Howard H. Bell, Jrs' Salt Lake 3, 553 n 533 e fr swc Sect 20-19s-15e, n extn.	5-12-48	713	653- 713		P 20	13
Los Angeles	Inglewood	M.G.N. Oil Co's Sentous 1-16, 100 s 500 w fr nec Lot A, Tract 1892, Sect 17-2s-14w.	5-26-48	1970	1965- 1970		P 35; 15 wtr	16
		ILLINOIS—New Oil Fields						
Clay	Sailor Springs, N.	J. W. Rudy & Witt's La Rue 1, sw sw nw 16-4n-8e, 2½ mi n Sailor Springs, E. pool.	6- 8-48	2991	2986- 2991	Rosiclare sd; Miss	P 66	
Edwards	Mills Prairie	O. Weston's V. Hasewinkle 1, nw nw nw 22-1n-14w, 2 mi sw Lancaster, W. pl.	6-22-48	2977	2924- 2929	L O'Hara li; Miss	P 33	
Effingham	Evers, S.	Dunbar Drlg Co's J. Repking 1, nw sw ne 8-7n-7e, 1½ mi sw Evers pl.	6- 8-48	2690	2652- 2660	Rosiclare sd; Miss	P 30; 4 wtr	
		ILLINOIS—New Oil Pays						
Clay	Sailor Springs, W.	Diamond Oil Exploration Co's D. V. Dillman 1, nw sw se 15-4n-7e, ½ mi s extension.	6-29-48	2996	2958- 2986- 2996	Rosiclare li; Miss McClosky li; Miss	P 18; 16 wtr	
Gallatin	Omaha	Carter Oil Co's R. M. York 2, 380 fr sl 330 fr el, se sw 33-7s-8e	6-22-48	1353	1321- 1353	Biebl sd; Penn	P 139; 20 wtr	
Wabash	Mt. Carmel, W.	Brubeck & Pappas' G. Chapman 1, 1132 fr sl 330 fr wl, se ne 14-1s-13w.	6- 8-48	2589	2542- 2551	L O'Hara li; Miss	P 115	
		ILLINOIS—Oil Field Extension						
Edwards	Bone Gap, S.	Calvert & Willis' B. L. Mayne 1, sw se ne 18-1s-14w, ½ mi n extension.	6-15-48	3223	3104- 3108	McClosky li; Miss	P 2; 14 wtr	
		INDIANA—New Oil Fields						
Gibson	St. James	Ernest Zink's Frances Maier 1, nw sw se 12-4s-11w	6-28-48	2392	2335- 2342	McClosky sd; L Miss	P 20; 15 wtr	
Gibson	Rochester	Olen D. Sharp-Ray Ryan-Aurora Gasoline Co's Berry et al 1, nw sw nw 13-2s-13w, 7 mi s Mt. Carmel.	6-15-48	2767	1898- 1955	Waltersburg sd; U Miss	P 800	
Gibson		C. E. Skiles-W. E. Brubeck's Columbus Smith 1, sw nw nw 13-3s-12w.	6-30-48	2636	1801- 1811	Waltersburg sd; U Miss	P 104	
Posey		S. D. Jarvis' W. P. Schweikart 1, sw ne sw 1-6s-12w, 1½ mi sw old Vienna pl.	6-30-48	1980	1969- 1979	Tar Springs sd; U Miss	P 10	
Posey	Ford	B. M. Heath & Indiana Farm Bureau's Jos. Fischer 1, nw ne nw, 22-6s-12w.	6-18-48	2261	2253- 2261	Cypress sd; U Miss	P 40; 25 wtr	
Posey		Ashland Oil—Kidd & Cherry's Papenmeier 1, 330 fr s&el se sw nw 4-6s-12w, 6 mi nw Evansville.	6-11-48	2407	2397- 2401	Cypress sd; U. Miss	P 75; 25 wtr	
Posey	Franklin, W.	B. M. Heath & Ind Farm Bureau's Dr. J. Y. Welborn 1-A, 330 fr s&wl sw nw ne 13-7s-12w, Marrs Twp.	6-18-48	1816	1804- 1811	Waltersburg sd; U Miss	P 40; 25 wtr	
Vanderburgh		Joe Resnik's Bertram Edmond et al 1, nw sw sw 10-7s-11w, Union Twp, 2 mi s Evansville.	6-11-48	2439	2435- 2439	McClosky li; L Miss	P 75	
		INDIANA—Oil Field Extension						
Pike	Union Bowman	J. T. Peek's Kinman & Dillin 1, se ne sw 15-1n-9w, ¾ mi n extension	6-30-48	977	960- 977	Waltersburg sd; U Miss	P 10	
		KANSAS—New Oil Fields						
Barton	Homestead	Raymond Gear et al's Eveleigh 1, se sw ne 22-18s-13w, 5 mi se Eveleigh pl.	6-30-48	3348	3307- 3320	Arbuckle li; Ord	P 35	
Cowley	Enterprise	Meade Prod Co.'s McMichael 1, nw se sw 35-33s-3e, 2 mi e Homer pl.	6-30-48	3398	3282- 3323	Bartlesville sd; Penn	P 20	
Rooks	Chandler	Harry Gore's Ruder 1, sw sw ne 14-9s-19w, 1½ mi s Barry pl, 1 mi n Jelinek	6-22-48	3462	3455- 3462	Arbuckle li; Ord	Sw 2400	
Rooks	Barry, W.	Westgate-Greenland's McClellan 1, nw nw ne 4-9s-19w, 1 mi w Barry pl.	6-29-48	3449	3442- 3449	Arbuckle li; Ord	P 314	
Saline		Deep Rock Oil Co's James 1, sw sw ne 8-16s-1w, 1½ mi n Hunter pl.	6-22-48	2696	2672- 2690	Mississippi li; Miss	P 60- 11 wtr	
Seward	Kismet	Stanolind O&G Co's Wheatley 1, c ne sw 23-33s-31w, 15 mi e Hugoton gas	6-29-48	7340	5095- 5100	Marmaton li; Penn	P 132; 88 wtr	
Stafford	Nellie	J. M. Huber Corp's Symns 1, ne ne se 28-22s-14w, 6 mi sw Curtis pl.	6-30-48	3945	3696- 3704	Lansing-K.C. li; Penn	P 480	
		NORTH LOUISIANA—New Oil Fields						
Caddo		H. J. Strief's Central Trading Co 2, 1650 fr nl 990 fr wl Sect 34-22n-15w, betw Caddo-Pine Island and Hosston fld.	6- 9-48	2571	2340- 2360	Paluxy sd; L Cre	F 83; ¼"	27.5
Catahoula	Saline Bayou	Hunt Oil Co's La. Delta Lbr Co et al 1, 660 fr nl 790 fr wl Sect 6-4n-5e.	6- 5-48	10442	5506- 5512	Wilcox sd; Eoc	F 437; $\frac{11}{64}$"	46
		NORTH LOUISIANA—New Gas Field						
Union	Downsville	Pan-American Prod Co's J. H. Albritton 1, 1980 fr n&wl Sect 10-19n-1e.	6- 5-48	8501	7378- 7390	Travis Peak sd; L Cre	24 mln; open	
		SOUTH LOUISIANA—New Oil Pays						
Acadia	Crowley, S.	Sun Oil Co's Leger 1, 1320 n 1470 w fr sec Sect 22-10s-1e	6-21-48	11514	8144- 8156		F 252; $\frac{1}{4}$"	25.7
Assumption	Napoleonville, N.W.	Shell Oil Co's Dugas & Leblanc Ltd 2, 660 n 01 deg 42 min w, th 660 s 88 88 deg 51 min w fr sec Sect 35-12s-13e.	6-13-48	10587	9845- 9856		F 268; $\frac{1}{8}$"	35.
LaFourche	Delta Farms	California Co's La Delta Fms 51, Unit 1, beg at nwc Sect 6, th s 1615, th e 2377 to locn in Sect 6-17s-23e.	6-10-48	6923	6908- 6914		F 135; $\frac{1}{8}$"	40.5
LaFourche	Bay De Chene	Texas Co's State-Bay De Chene Lse 356-6, s 79 deg 50 min 40 sec w 5216 fr USCGS Mon. "BUR" in Bay De Chene.	6- 7-48	8940	3696- 3702		F 32; $\frac{1}{32}$"	28.9
St. Mary	W. Cote Blanche Bay	Texas Co's State-W. Cote Blanche Bay Lse 340-36, n 32 deg 27 min 37 sec e 23,727.7 fr USCGS Mon. "NED".	6-18-48	2100	1924- 1934		F 129; $\frac{11}{64}$"	20.5
St. Mary	Jeanerette, S.	Atlantic Ref Co's Joe A. Blanchard 3, 1919 fr nl 1333 fr el swc Sect 37-13s-9e	6-21-48	6608	6524- 6534		F 154; $\frac{1}{8}$"	37
		SOUTH LOUISIANA—New Distillate Fields						
Acadia		J. C. Hawkins et al's Delussa Vidrine Young 1, Sect 19-7s-2w, betw Tepetate & Tepetate, W. flds.	6-22-48	9157	8530- 8536	Marginulina sd; Mio	F 92; 5 mln; ¼"	60.4
Cameron	Holly Beach	Magnolia Pet Co's Abel West Hrs 1, 660 s 1980 e of nwc Sect 7-15s-10w, 1½ mi se Mud Lake fld.	5-23-48	11630	10817-10822		F 55; 3.4 mln; $\frac{1}{16}$"	53.2
St. Landry		Superior Oil Co's Louis Savoie 1, 462.94 n 1327.16 w of sec Sect 37-8s-3e, 1¼ mi s Cankton fld.	6-20-48	11024	10550-10560	L Broussard sd	F 30; 3.8 mln; ¼"	49.7
		SOUTH LOUISIANA—New Gas Field						
Calcasieu		Sohio Pet Co's Sweet Lake Ld & Oil Co's C-1, s 89 deg 43 min e 2058.3 & s 2075 fr nwc Sect 34-10s-6w, 3 mi s Bon Air fld.	5-29-48	12010	10882-10898		1 mln; ⅛"	
		SOUTH LOUISIANA—New Gas Pay						
St. Mary	Jeanerette, S.	Atlantic Ref Co's Adeline Sugar Factory Co B-2, Sect 37-13s-9e	5-30-48	8277	3210- 3220		1 mln; ¼"	
		MICHIGAN—New Oil Field						
Oceana	Pentwater	Roosevelt Oil Co's Leone McMillen 1, sw ne nw 6-16n-17w, Weare Twp.	6-11-48	2092	2088- 2092	Dundee sd; Devo	F 100	
		MONTANA—New Oil Pay						
Carbon	Elk Basin, NW	Sinclair Wyoming's H. G. Wilkins 2, sw nw nw 28-9s-23e	6-18-48	4676	4598- 4622	Lakota sd; L Cre	F 504; ⅜"	49.5
		NEW MEXICO—New Oil Pay						
Lea	Brunson	Rowan Drlg Co's Will Cary 5, 1650 fr nl 2310 fr wl Sect 22-22s-37e	6-17-48	8086	7140- 7190	Montoya li; Ord	F 213	39
		NEW MEXICO—New Gas Pay						
Lea		Devonian Oil Co's Landreth 1, 660 fr nl 1980 fr wl 18-9s-38e.	5-31-48	5015	4935- 4959		2.8 mln.	
		OKLAHOMA—New Oil Fields						
Garvin		Republic Nat Gas & Carter Oil Co's Masters 1, se nw sw 25-3n-3w	6-24-48	7851	7085- 7100 7258- 7263	Gibson sd; Penn Hart sd; Penn	F 243; ¼" F 336; open	45 62.9
McClain	E. Newcastle	Magnolia Pet Co's Ben Arnold 1, c sw se 13-9n-4w	6-30-48	9433	8886- 8901	Chimney Hill li; Devo	F 294; ¼"	39
Murray		Sohio Oil Co's Kirby 1, nw nw nw 19-1n-3e	6-24-48	2223	1920- 1935	Oil Creek sd; Ord	P 8	17.8
Okfuskee		J. E. Crosbie Inc & Warren Pet's Crain 1, sw sw ne 19-12n-7e	6-10-48	4331	4308- 4331	Hunton li; Devo	F 284; $\frac{1}{16}$"	42
Payne		Blackwell O&G Co's Bryant 1, nw sw se 6-18n-5e	6-17-48	3715	2845- 2863	Cleveland sd; Penn	P 61	
Pottawatomie	Avoca, SE	J. G. Buell Inc's Bankston 1, cel se nw 12-6n-3e, 1 mi fr Avoca pl.	6-24-48	4301	4255- 4261	Viola li; Ord	F 368; open	38.7
		OKLAHOMA—New Oil Pays						
Carter	Camp	Continental Oil Co's Eason 1, sw nw nw 6-2s-3w	6-10-48	4846	4231- 4240	U Tussey sd; Penn	F 279; $\frac{1}{8}$"	36
Pottawatomie	St. Louis, N.	Russel Maguire & R. H. Vise's Bradburn 1, se sw ne 23-8n-4e	6-30-48	4430	4415- 4430	1st Wilcox sd; Ord	P 90; 10 wtr	
		OKLAHOMA—Oil Field Extension						
Stephens	Sholem Alechem	Magnolia Pet Co's Turner 1, sw se ne 34-1n-4w	6-16-48	5461	5300- 5375	Springer sd; Penn	P 231	23.3
		OKLAHOMA—New Gas Field						
Hughes	Gerty, N.	Graben Gas & Water Co's Hundley 1, se sw nw 29-5n-10e	6-24-48	1765	1755- 1765	Pennsylvania sd; Penn	4 mln	
		TEXAS—District 2 (MIDDLE GULF COAST)—New Oil Field						
Bee	Holsmark-Wilcox	Gasoline Prod Corp's Holsmark Est 1, 330 fr nw&swl of Thos P. Rhodes Sur, 40-ac Lse, 1 mi sw Mineral fld.	6-18-48	8130	8108- 8114	Slick sd; Eoc	F 108; $\frac{1}{32}$"	27.6
		TEXAS—Dist 2 (MIDDLE GULF COAST)—New Oil Pays						
Calhoun	Long Mott, E.	C. G. Glasscock & Pontiac Ref Co's T. A. McDonald 2, 467 fr ne&sel of 160-ac Lse, Sect 19, R. Garrott Sbdn 1.	5- 9-48	7563	7072- 7078 7214- 7238		F 120; $\frac{1}{32}$" F 130; $\frac{1}{32}$"	41
Goliad	Gottschalk	W. L. Goldston's Mary Meyer 1, 467 fr nl 430 fr el of St. Luke de Mott Sur, ¾ mi sw disc well.	6-17-48	7880	7683- 7689	Massive Wilcox sd; Eoc	F 120; $\frac{1}{16}$"	34.6

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COUNTY	FIELD	COMPANY, WELL AND LOCATION	Date Completed	Total Depth (Feet)	Completion Horizon (Feet)	[1]Name, Character and Age of Producing Formation	[2]Initial Production Method and Choke	Gravity of Oil
Refugio	Refugio-Fox	La Gloria Corp's Jamie Hynes B-5, 1425 fr sl 2130 fr el 1757-ac "B" Lse, Isabella O'Brien Sur.	6-10-48	3581	3557- 3562		F 83; 17 wtr 8/64"	23.2
		TEXAS—District 2 (MIDDLE GULF COAST)—New Distillate Pay						
Calhoun	Long Mott	Fullerton Oil Co & Ryan Consol Pet's Carrie McDonald 1, 467 fr nwl 1338 fr swl 242.29-ac Lse, Miguel Castillo Gr.	6-12-48	10495	9634- 9652		F 170; 4 mln; 1/4"	55.4
		TEXAS—District 2 (MIDDLE GULF COAST)—Dist. Field Extension						
Lavaca	Hope	Shell Oil Co's Yoakum Nat Bank 1, 1500 fr nwl 3250 fr swl Wm Mimms Sur, 483.59-ac Lse, 1 mi w extension.	6- 2-48	7782	7712- 7728	Wilcox sd; Eoc	F 66; 1.6 mln; 1/2"	54.6
		TEXAS—District 3 (UPPER GULF COAST)—New Oil Fields						
Harris		Grubb & Hawkins' Mrs. Blanche G. Rogers 1, 1980 fr sel 660 fr nel 652-ac Lse, WCRR Sur, 3, 1 mi sw Bammel.	4-29-48	7327	6420- 6424		F 39; 4/16"	33.2
Jefferson	Hildrebrandts Bayou	James F. Morse & Co's Wallace Talbot 1, 3375 fr sl 1075 fr wl of Jas. McNabb Sur in Blk 2, 1¼ mi s of Lovell Lake fld.	6-28-48	8210	7759- 7761		F 166; 1/8"	39.4
Wharton	Lane City Townsite	Sohio Pet Co's Lane City Townsite Unit 1, 90 fr sel 30 fr nel Blk 27, D.D.D. Baker Sur, 3 mi ne Lane City prod.	6-18-48	6282	5464- 5478	Frio sd; Olig	F 207; 5/32"	25.9
		TEXAS—District 3 (UPPER GULF COAST—New Oil Pays						
Brazoria	Manvel	The Salt Dome Oil Corp's C. W. Way et ux 2, 330 fr swl 500 fr nwl of lot 39, Thos Spragens Sur.	6-17-48	5870	5786- 5792		F 79; 47 wtr; 1/4"	29.1
Colorado	Glasscock	Coast Co's C. G. Glasscock Unit 1, 660 fr nl 330 fr el 640-ac Lse BBB&C Sur, 1 mi sw of disc.	6- 1-48	9580	9492- 9546	Wilcox sd; Eoc	F 121; 5/32"	41.2
Fort Bend	Boling Dome, N.	British-American Oil Prod Co's J. M. Moore 1, 1920 fr nel, 330 fr sel of 200-ac Lse, Chas. A. Bettner Sur.	6-23-48	4180	3762- 3769	Frio sd; Olig	F 114; 1/8"	23
Harris	Humble	Wilson Oil Co's R. E. Burt 17, 1670 fr wl 100 fr sl of 50-ac Lse, J. B. Stevenson Sur.	6-27-48	3192	3146- 3156		F 145; 11/64"	22.3
Liberty	S. Liberty	Floyd L. Karsten's Leon Mitchell 2, 500 fr nl 1550 fr wl 40-ac Lse, M. G. White Sur, ne flk of fld.	6-13-48	6658	5830- 5868 6404- 6432	"C" sd "T" sd	F 287; 4/16" F 216; 1/8"	37.2 40.7
		TEXAS—District 3 (UPPER GULF COAST)—New Distillate Field						
Newton		American Republics Corp's Newton Co. Lbr. Co. 1, 1399 fr nl 466 fr wl 640-ac Lse, P.L.&I. Wheaton Sur, Sect 2, 1¼ mi s Cist fld.	6- 5-48	7852	7322- 7324		F 150; 10 mln; 1/4"	54.3
		TEXAS—District 3 (UPPER GULF COAST)—New Gas Field						
Liberty		Texas Co's John A. Derring et al 2, 700 fr nl 1800 fr wl 1133.39-ac Lse, H&TC Sur, Sect 134, e of old Dayton dome.	6- 4-48	8113	7550- 7554		2.4 mln; 4/16"	
		TEXAS—District 3 (UPPER GULF COAST)—New Gas Pay						
Brazoria	Danbury, S	Humble O&R Co's Roberson Fst 1, 467 fr nwl 990 fr nel 505 fr swl of Sarah M. Smith 68.93-ac Tr., H. Austin Lge 5.	5- 6-48	8642	7971- 7976		3 mln; 1/4"	
		TEXAS—District 4 (LOWER GULF-S.W.)—New Oil Fields						
Duval		Texas Co's Duval Co. Ranch Co. NCT-49, 1, 330 fr s&el Narcisco Hernandez Sur 54, 1 mi w Govt. Wells-Venus fld.	5-27-48	2912	1800- 1810		P 10	24
Duval		Magnolia Pet Co's Brought B-1, 320 fr s&wl of 320-ac Lse el/2 J. L. Saenz Sur 156, 1 mi ne Charamouser-Wilcox fld.	6-20-48	3017	2064- 2067		P 54	32.9
		TEXAS—District 4 (LOWER GULF-S.W.)—New Oil Pay						
Nueces	Agua-Dulce	Seaboard Oil Co's J. C. Robertson 3, 467 fr wl 1898 fr nl Blk 5	6- 6-48	6516	6507- 6512		F 125; 5/32"	34
Starr	Jay Simmons	Sunray Oil Corp's Dr. Jose G. Garcia 1, 330 fr el of Santa Cruz Gr & 2322 s of rl of 391-ac J. G. Garcia Fee, 231.73-ac Lse.	6-23-48	6505	6128- 6135 6192- 6202		F 115; 4/16" F 107· 1/8"	35 36.7
Starr	Coastal	Coastal Ref Inc. & W. D. Kennard's Luis Pena B-2, 566 fr el 330 fr sl 51.12-ac "B" Lse.	6-27-48	6003	3548- 3554		F 94; 1/8"	40.5
		TEXAS—District 4 (LOWER GULF-S.W.)—Oil Field Extension						
Starr	Sun	Sun Oil Co's Geo. H. Speer-State D-1, 330 fr n&wl of Geo. W. Speer Sur 274, on 630.44-ac "D" Lse, ½ mi s extension.	6-29-48	4725	4713- 4725	Frio sd; Olig.	F 72; 3/16"	46.5
		TEXAS—District 4 (LOWER GULF-S.W.)—New Distillate Fields						
Nueces		Skelly Oil Co's Richard King 1, 467 fr wl 470 fr nl Sect 27, Richard King Fm Lots, 2 mi s Richard King fld.	6-10-48	6213	5432- 5450		F cond; 8.5 mln; open	
San Patricio		F. M. Boykin Jr's C. V. Jones A-1 (OWDD), 467 fr s&wl of n-100-ac of ne¼ Sect 67, Geo. H. Paul Sbdn of Coleman-Fulton Pastr Co Lds.	6- 7-48	7506	6578- 6586		9 mln; open	64
		TEXAS—District 4 (LOWER GULF-S.W.)—Distillate Field Extenson						
Hidalgo	La Reforma	Humble O&R Co's Arcadio Guerra 1, 467 fr w'ly nl 467 fr w'ly wl of sh No. 8 orig partn of San Jose Gr, se extension.	6- 8-48	7960	6357- 6366		F 59; 3 mln; 1/4"	55.6
		TEXAS—District 4 (LOWER GULF-S.W.)—New Gas Field						
Duval	Lundell, S	Magnolia Pet Co's J. C. Wilson 21, 660 fr wl 1320 fr nl P.E. White Sur 136.	6-10-48	2807	1460- 1465		28 mln; open	
		TEXAS—District 6 (NORTHEAST)—Oil Field Extension						
Wood	Quitman	George & Wrather Drlg Co's W. A. Spruell 1, 4200 fr nl 3200 fr el of H. Anderson Sur, ne extension.	5-18-48	4303	4171- 4182	Blalock sd; U Cre	P 28	26.2
		TEXAS—District 7-B (NORTH CENTRAL)—New Oil Fields						
Eastland	"Kleiner"	Lone Star Prod Co's Chas K. Kleiner "A" 1, 330 fr sl 1350 fr wl Sect 81, Blk 4, H&TC Sur, 2 mi n Cisco.	6-25-48	4105	4000- 4014	Mississippi li; Miss	F 204; 4/16"	43.8
Jones		Richard L. Davisson Jr's H. H. & M.T. Ramsey 1, 1660 fr nl 660 fr el Sect 80 Plk 14, T&PRR Sur, 2½ mi nw Hamby.	6-11-48	1701	1698- 1701	Saddle Creek sd; Penn	F 125; 1/4"	40
Jones		Danciger O&R Co's R. L. Stephenson 1, 660 fr wl 9500 fr sl M. Fragosa Sur, Blk 267, 3¼ mi ne Noodle.	6-16-48	2936	2910- 2936	Gunsite li; Penn	P 71; 17 wtr	37.5
Jones		C.U. Bay & B. H. Hilburn's Mrs. Odie S. Mathews 1, 990 fr nl 625 fr el Lot 39, Blk 149, De Witt CSL Sur, 5 mi e Merkel.	6- 8-48	4657	4640- 4657	Strawn sd; Penn	F 91; 4/16"	44
Taylor		West Central Drlg Co et al's Ennis Reidenbach 1, 330 fr n&wl Blk 12, Lge 146, Grimes CSL, 10 mi s Merkel.	6-10-48	2886	2498- 2503	Limestone	F 640; 4/16"	42
Taylor		Phillips Pet Co's T. C. Humphreys 1, 1541 fr el 330 fr sl Lot 22, Lge 147, Grimes CSL Sur, 1 mi e Merkel.	6-25-48	2700	2684- 2700		F 368; 1/4"	41
		TEXAS—District 7-B (NORTH CENTRAL)—New Oil Pay						
Jones	Jones Co. Regular	Hedrick Oil Co. et al's H. M. Connally 1, 330 fr sl 1544 fr wl Lot 3, A.W. Hill Sur 4, 2½ mi sw Lueders.	6- 4-48	1972	1967- 1972		P 104	39.4
		TEXAS—District 7-B (NORTH CENTRAL)—Oil Field Extension						
Wise	Chico	Kingwood Oil Co's R. O. Garrett 1, 330 fr sl 4850 fr wl C. W. Egery Sur, 1¼ mi nw extension.	6-15-48	5400	5338- 5354	Bend cgl; Penn	F 260; 1/4"	
		TEXAS—District 7-C (WEST CENTRAL)—New Oil Field						
Schleicher		Phillips Pet Co's Mrs. W. J. Weddell 1, 662.5 fr nl 660 fr el Sect 72, Blk M, GH&SA Sur, 11 mi se Christoval.	6-17-48	6150	5630- 5700	Strawn sd; Penn	P 35	36.5
		TEXAS—District 7-C (WEST CENTRAL)—New Oil Pay						
Upton	McCamey	Texas Pacific Coal & Oil's J. F. Lane "A" Acct 2-62, 1980 fr sl 1980 fr el Sect 5, GC&SF Sur.	6- 8-48	8213	8070- 8130	Ellenburger dolo; Ord	F 60; 90 wtr; 1/2"	43.1
		TEXAS—District 8 (WEST)—New Oil Fields						
Andrews		Humble O&R Co's J. E. Parker 12, 660 fr s&wl, Sect 2, Blk A-54, PSL Sur, 3½ mi w Martin pl.	6- 5-48	10398	8390- 8420	Devonian	F 636; 57 wtr; 3/8"	36
Cochran		Seaboard Oil Co's F. O. Maston 1, 660 fr n&wl Lab. 18, Lge 152, Randall CSL Sur, 8 mi se Bledsoe.	6-27-48	5133	4967- 5001		P 185	31.5
Crane		Standard Oil Co of Texas' Hattie A. Reynolds 1, 660 fr ne&sel Sect 22, Blk 3, H&TC Sur, 5 mi n Abell pl.	6-26-48	5869	5831- 5869	Waddell sd; Ord	F 880; 3/8"	39.9
Hockley		Honolulu Oil Corp's Elwood Est 1-A, 660 fr n&wl Sect 13, Blk A, R. M. Thompson Sur, 3½ mi n Smyer.	6-23 48	6014	5875- 5905	Glorietta sd; Perm	Sw 236	34.3
Sterling	"Spade"	Humble O&R Co's I. L. Elwood Est "B" 1, 660 fr nl 1980 fr wl Sect 56, Blk 18, SPRR Sur, 5 mi ne Iolanthe.	6- 1-48	8000	7970- 7980	Ellenburger dolo; Ord	F 112; 4/4"	47.4
		TEXAS—District 9 (NORTH)—Oil Field Extension						
Archer	Burns-Jones	L. T. Burns' G&C Prideaux 1, 1000 fr nl, 2003 fr el Sect 1835, TE&L Sur, 2 mi sw extension.	6-22-48	3178	3168- 3178		P 125	42
		WYOMING—New Oil Fields						
Big Horn		Iris Oil Co's Gov't. 2, nw nw nw 8-54n-93w, Crystal Creek Feature	6-25-48	997	964- 980	Tensleep sd; Penn	P 25	18.7
Weston		Brinkerhoff Drlg Co's Mandell 1, nw sw sw 3-44n-62w, 6 mi e Mush Creek	6-25-48	3067	3055- 3065	Newcastle sd; U Cre	F 288; 1/4"	
		WYOMING—New Oil Pays						
Carbon	Medicine Bow	Ohio & California's Kyle 6, 1790 fr nl, 560 fr el, ne se ne 26-21n-79w	6-17-48	6916	6666-	Tensleep sd; Penn	F 840; 3/8"	61
Sweetwater	Lost Soldier	Sinclair Wyoming's Drayton-Consolidated 2, (OWDD) se ne se 3-26n-90w.	6-30-48	6288	6096- 6172	Cambrian	F 720	34.5
		WYOMING—Oil Field Extension						
Weston	Mush Crk., E.	Beaver Oil Co's Shostock 1, ne se ne 13-44n-63w	6-25-48	3598	3558- 3578	Newcastle sd; U Cre	P 50	

[1] Character of producing formations abbreviated thus: ch, chalk; dolo, dolomite; li, limestone; sd, sandstone; sh, shale; sur, serpentine; cgl, conglomerate. Ages of formations abbreviated thus: Plio, pliocene; Mio, Miocene; Olig, Oligocene; Eoc, Eocene; U. Cre, Upper Cretaceous; L. Cre, Lower Cretaceous; Jur, Jurassic; Tri, Triassic; Perm, Permian; Penn, Pennsylvanian; U. Miss, Upper Mississippian; L. Miss, Lower Mississippian; Devo, Devonian; Sil, Silurian; Ord, Ordovician; Cam, Cambrian.

[2] Barrels of oil per day (24 hr. rate), flowing (F), pumping (P), swabbing (Sw), or bailing (B); or million cubic feet of gas daily open flow capacity; size of choke given in inches.

Cuyama Valley Discovery MAY IMPROVE CALIFORNIA RESERVES

View from highway looking northwesterly toward Anderson-Colgrove area. Derrick of Anderson-Colgrove 26-30, which showed initial production rate of 6000 barrels per day on drill-stem test is visible to left of tank battery.

By GILBERT M. WILSON
Staff Writer

COMPLETION of three wells in the Cuyama Valley area seemingly indicates that a new area may be developed sufficiently to provide an important addition to California's reserves. This article presents the initial first-hand outline of progress to date, showing probable developments and covering geologic and other basic information.

ONE of the most significant discoveries in California in recent years apparently exists in Richfield Oil Corporation's completion in June of two high gravity flowing wells in Cuyama Valley. The company's Russell A-28-5, completed on June 13, came in for an initial production of 508 barrels per day of 38.3 gravity oil flowing through 48/64 bean. Their second well, Anderson-Colgrove 37-30, located some 2¼ miles northwest of the Russell well, was brought in on June 18 for an initial production of 4000 barrels per day of 33.3 gravity oil through 1½-inch bean. Subsequently production from this second well has been reduced to about 600 barrels per day flowing through 18/64 bean. Both wells, producing from sand bodies of between 200 and 300 feet in thickness, produce from total depths of slightly over 3000 feet.

Further underscoring the importance of the new discovery is the announcement, just released at the time of this writing, that Richfield's third well, Anderson-Colgrove 26-30,* located about 1000 feet northwest of their Anderson-Colgrove 37-30, on drill stem test from shoe at 2780 feet, flowed at a 250 barrels per hour rate, or 6000 barrels per day rate, of 33 degree gravity oil.

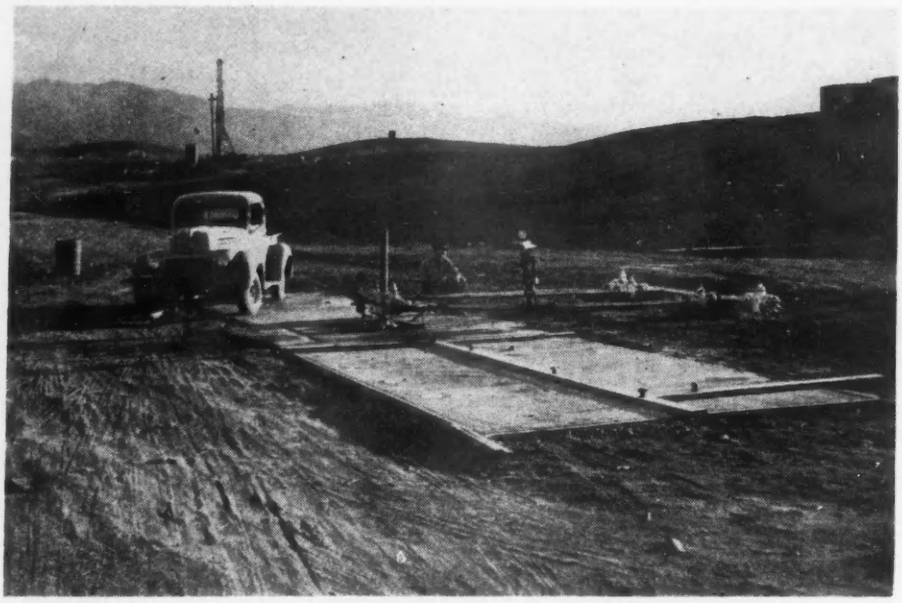
To date, there have been some differences of opinion among geologists and others familiar with the area as to whether the two productive areas ultimately will be joined. Some think the Russell and Anderson-Colgrove areas ultimately may be linked together, perhaps by a narrow neck of producing wells, while others believe the present widely separated wells are on separate structures. Differences in gravity and types of the two structures lend support to the latter belief, but only more drilling will determine the exact nature of the field or fields.

Exploration is proceeding cautiously, with the bulk of activity being limited to direct offsets of the two initial wells. Richfield currently is running six contract strings of tools, and other operators, to date independent companies, account for three more rigs. Other companies, including several majors, are reported to be blocking up large pieces of acreage in the valley and it is likely that other wildcat wells will be started shortly.

Of special importance to California is the fact that the discovery opens up to further exploration a relatively large area

* Richfield Oil Corporation's Anderson-Colgrove 26-30, which demonstrated a 6000-barrel drill stem test July 7, was completed July 15 after plugging back to 3125 feet and setting 367 feet of 6⅝-inch liner containing 346 feet of 100 mesh perforation.

The well was first produced at a rate in excess of 10,000 barrels per day with one million feet of gas, but the company has reduced the flow to a more moderate rate. The well produces from Vaqueros of Lower Miocene age.



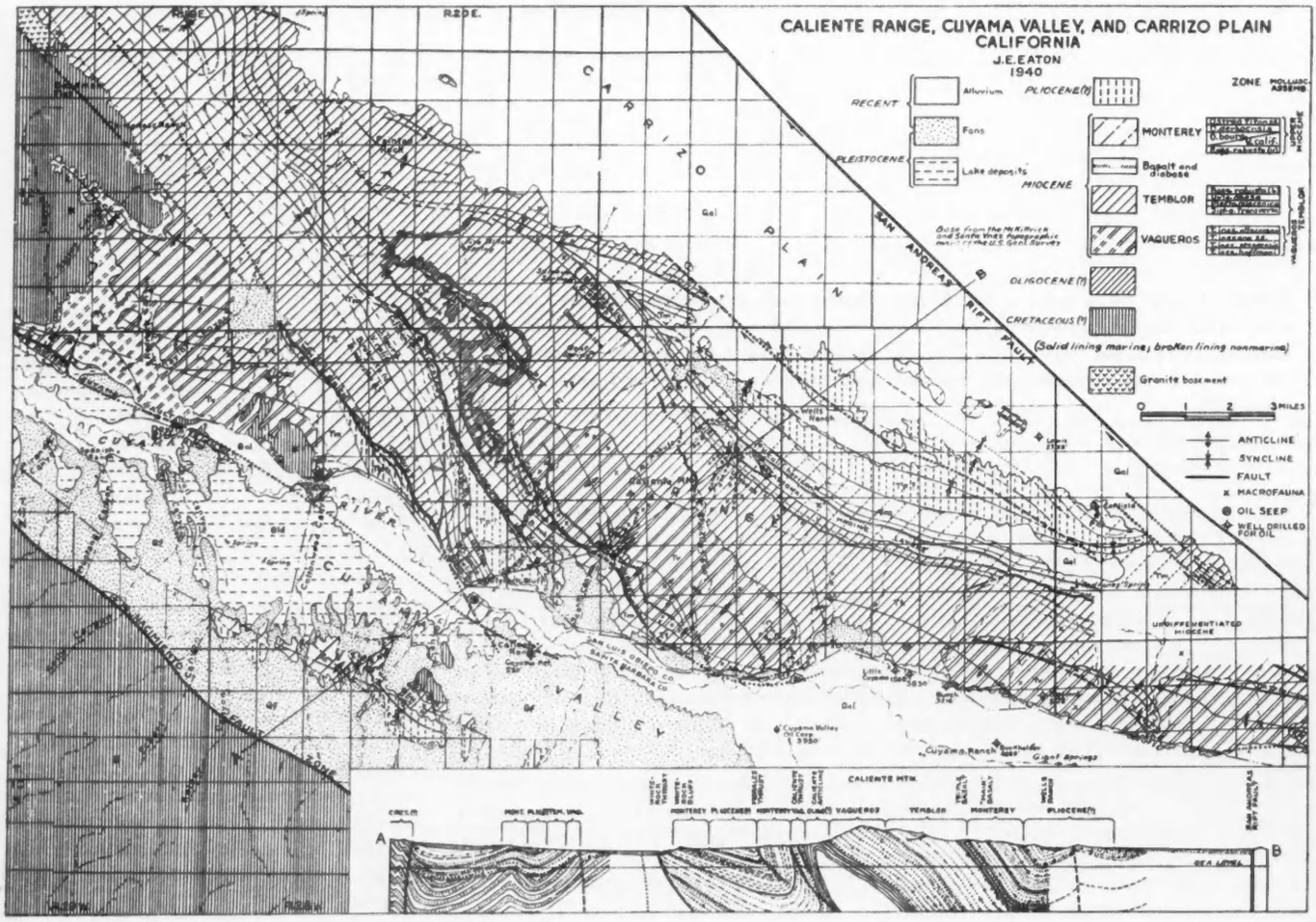
View looking in southerly direction showing Richfield's discovery well, Russell A-28-5 in foreground, currently producing 407 barrels per day 38.3 gravity oil through 26/64 bean. This completion was followed within a week by the Anderson-Colgrove 37-30 well completion some 2¼ miles to the northwest.

or province which hitherto had been considered of minor or even negligible importance as an oil producing region. In years previous, scattered attempts to develop production in other parts of the valley yielded little or no shows of oil and further exploration was discouraged. The highly broken-up and generally unfavorable reservoir conditions throughout much of the valley were, according to many geologists, factors which would tend to localize or even eliminate possible commercial accumulations of oil.

Cuyama Valley is a large sedimentary basin approximately ten to 15 miles wide by 50 miles long, lying parallel to and about midway between the southern end of San Joaquin Valley and the Coastal Region, both important oil producing regions. It is the belief of some authorities that the productive area of the present field or fields, based on present wells, may amount to between 500 and 1000 acres, but whatever the ultimate acreage, the important fact remains that high gravity crude has been found, producing from sand bodies of considerable thickness and at relatively shallow depths, factors, incidentally, which encourage prospecting even though a few dry holes may be drilled in the process of development.

Richfield Oil Corporation, currently the largest leaseholder in the area with a reported 150,000 acres under lease or control, has been actively geologizing and prospecting in the area for the past four years. It is reasonable to assume that other structures of some promise may be included in the acreage under lease.

A development which triggered an even more intense search for oil produc-



Geologic map of Cuyama Valley and environs, California, from Bulletin 118, California Division of Mines. The Norris discovery well is about one-fourth mile northwest of the circled oil seep in the bed of Cuyama River (near Whiterock Bluff). Richfield's Anderson-Colgrove 37-30 producer is about one-half mile east of the seep. Richfield's Russell A-28-5 discovery well is just west of the V in the word Valley.

tion in the region, however, was the completion in January of this year of Norris Oil Company's Russell No. 1. This well, located approximately a half-mile northwest of the Anderson-Colgrove area, was drilled to a total depth of 1990 feet and plugged back to 1918 feet. It came in flowing at a 150 barrel per day rate of 18 degree gravity oil, but because of its structural position, its lower gravity oil, and presence of water, together with the fact that a dozen dry holes were drilled in the same vicinity in an unsuccessful effort to extend the production, importance of the discovery was at first discounted.

Completion of Norris Well

Completion of the Norris well, however, served to publicize and focus attention on the area and demonstrated conclusively that commercial production in the valley was possible. Completion of Richfield's Russell A-28-5, in June, removed any doubt as to the potentialities of the region.

Prospecting in the area is difficult, due to the fact that intense erosion, faulting of both normal and thrust types, and manteling of much of the area with alluvium, have obscured and made difficult the interpretation of the structural geology. According to J. E. Eaton, consulting geologist of Los Angeles who has published several technical papers on the Cuyama district:

"Cuyama Valley is a small intermontane valley occupying part of what was in Miocene time a narrow marine channel to southern San Joaquin Valley.

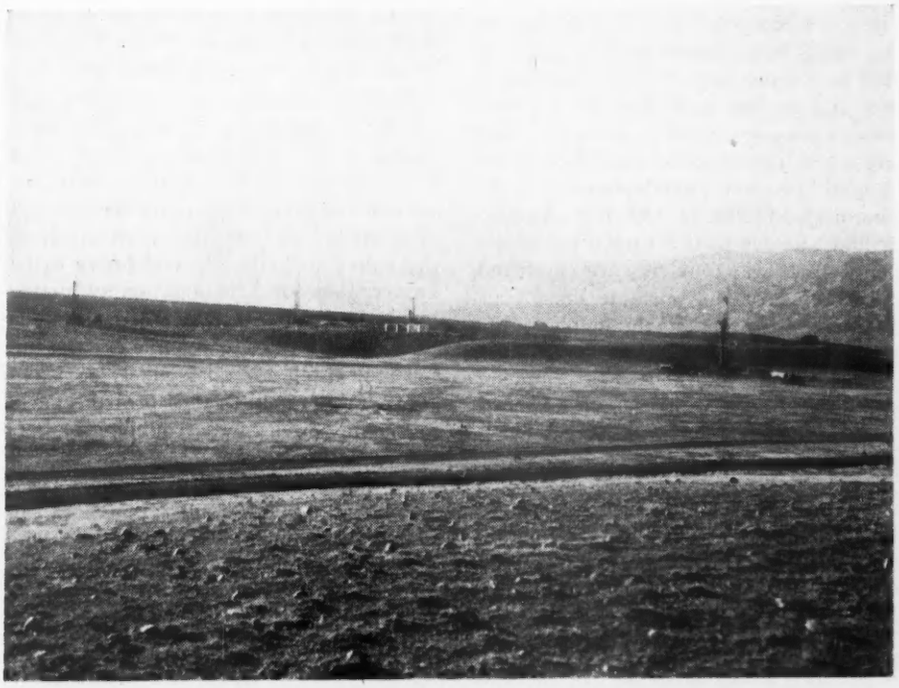
View looking generally northwesterly in the Andereson-Colgrove sector. Well in foreground is Anderson-Colgrove 37-30 which currently is flowing 610 barrels per day of 32.8 gravity oil through 18/64 bean. Well in background, Anderson-Colgrove 26-30, on drill-stem test from 2780 feet, indicated initial production of 6000 barrels per day. It is being cored deeper.

Cuyama Valley has since been so highly deformed, overthrust, and deeply eroded that most of its mountainous edges, and much of the valley itself, no longer retain an appreciable thickness of favorable rocks. A medial syncline still has a band of petroliferous shales with intercalated sands.

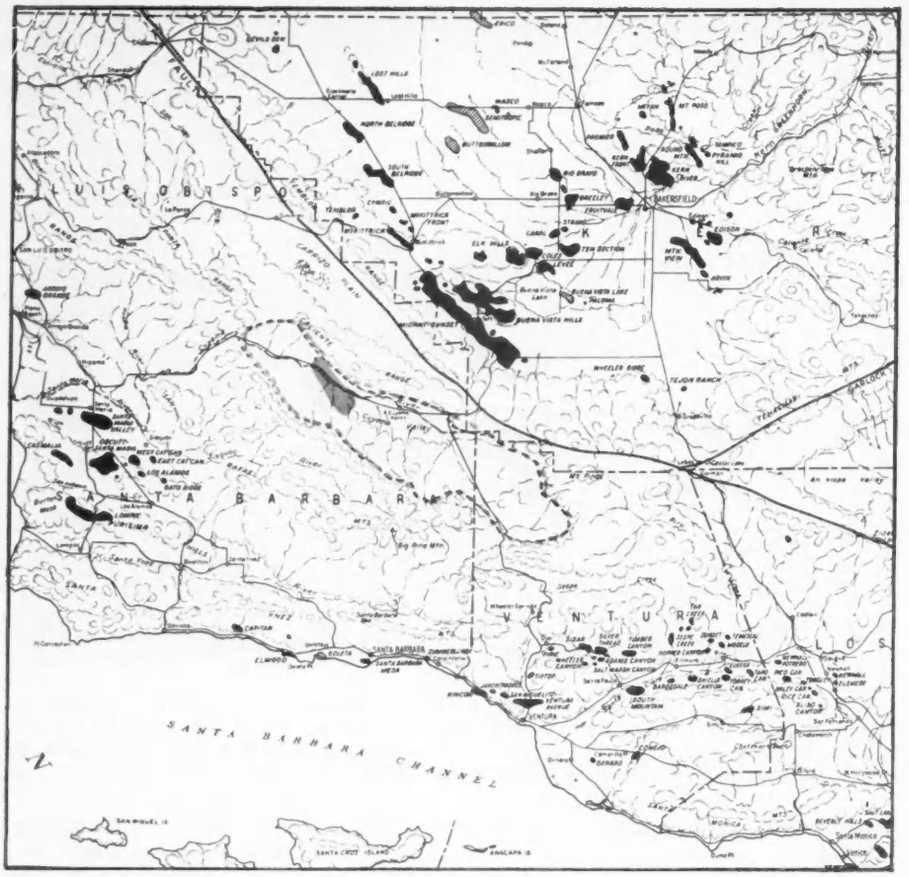
"The three discovery wells currently producing are along one line of anticlinal crumpling against a major fault which is locally overthrust. This line of crumpling appears to be cut by several small, unpublished secondary faults that branch diagonally from the overthrust. The secondary faults tend to obstruct the path of gas and oil migrating up-dip from the syncline. Much of the gas has seemingly escaped through the thrust zone. Part of the oil has apparently been trapped on the downthrow side of one or more of the diagonal faults, together with enough gas to cause the oil temporarily to flow. Some oil has been trapped in or near a locally closed anticline along the main thrust.

"From northwest to southeast the current producing areas appear, from surface mapping by the writer, to consist of (1) a southeasterly-plunging anticlinal nose, without observed dip closure, on which the Norris discovery well is situated; (2) a shallow saddle, down-dip from which Richfield's Anderson-Colgrove 37-30 well is producing seemingly on the downthrow side of an unpublished secondary fault diagonally cutting the saddle; (3) a narrow, closed anticline southeast of the saddle, on or near which Richfield's Russell A-28-5 discovery well seems to be situated. There is no assurance that the various surface aspects mentioned persist at depth. Only full development can reveal detailed relations.

"Evaluation of the various discoveries is currently precarious, not only because few wells are producing, but because the two more commercial of these seem to be on different local structures and may or may not be separated by a barren strip. According to differing interpretations, present development may have disclosed about 400 acres, possibly 800 acres, for



General view of Russell area, looking in northwesterly direction. Between road and drilling wells is a landing strip used by company planes in reducing travel time to and from the comparatively remote area. Anderson-Colgrove area is approximately 2¼ miles in the distance, at base of lower range of hills.



Generalized regional map showing location of Cuyama Valley in relation to San Joaquin Valley and Coastal Region fields. Shaded area within outline of Cuyama Valley is approximate location of current activity.

perhaps moderate average production of oils. There is commonly danger of low gas pressure near a major thrust fault. On the other hand, the particular oils are of fairly high gravity and are from shallow depths.

"Cuyama Valley is dangerous territory to prospect unless its basic geologic controls are realized. Areas having favorable rocks are limited. There are many obvious anticlines, but in most the known rocks are unfavorable. The boundary between limited favorable regions and large unfavorable regions is geologically distinct."

Completion Methods Conventional

Drilling in the area is comparatively easy, the formations penetrated being of alternating sands and shales of marine origin of Pliocene and Miocene age, the stratigraphic column being similar to that found in the San Joaquin Valley. While age of the producing horizon is as yet not positively identified, it is the belief among some authorities that the sand is of Lower Miocene age. The productive interval of the Russell well is a 300-foot body of alternating sands and shales, having a net sand thickness of about 250 feet. The Anderson-Colgrove discovery well to the northwest of the Russell well has a perforated interval of some 220 feet. Oil sand in the latter well was rather coarse and very permeable.

Drilling and completion methods are conventional. In the several Richfield wells so far completed or ready to complete, surface string of 10¾- or 11¾-inch pipe is set at about 200 feet. Open hole is carried down from there to the top of the sand, encountered at about 2800 to 2900 feet, depending upon structural position and surface elevation. An 8⅝-inch water string is cemented above the sand and a 6⅝-inch pre-perforated liner is set through the sand, total depth of the wells ranging from 3000 to 3300 feet. Average drilling and completion time is two weeks per well. Power type rigs are employed, some being of the portable mast type. Water for drilling is obtainable in the vicinity.

Current status of the several producing wells at this writing is as follows:

Norris Oil Company's Russell No. 1 at last report was flowing at about 40 barrels per day of 18 degree gravity oil through 12/64 bean, with 71 percent cut.

The Russell A-28-5 is flowing 407 barrels per day through 26/64 bean, with tubing pressure ranging between 120 and 300 pounds, and casing pressure ranging between 520 and 720 pounds.

The Anderson-Colgrove 37-30 is flowing at a 610 barrel per day rate with ½ of 1 percent cut through 18/64 bean, with 480 pounds on the tubing and zero on the casing. This well was completed with a packer in the annular space between tubing and casing. Gas-oil ratio figures are not available, but it is understood that they are comparatively low.

The third Richfield well, Anderson-Colgrove 26-30, which, on drill stem test indicated an initial production rate of 6000 barrels per day, is being cored deeper to explore possibility of there being deeper production zones.

From preliminary information obtained on the status of currently drilling offset wells, it is apparent that the Anderson-Colgrove area may demonstrate greater potentialities than the Russell area. In the latter, drilling has showed that the structure is relatively narrow in width and it may be that one or two wells are too far down the flank. At this early stage, however, it is dangerous to predict the outcome of any well.

Pipe Line Being Laid

To date, oil has been trucked out, being delivered to Richfield's lake pump station some 30 miles distant in the Midway-Sunset area of the San Joaquin Valley. However, a six-inch crude line has been started which will tie in the new field with the company's ten-inch crude line running to their refinery at Wilmington in the Los Angeles Basin. It is understood that the six-inch line is to be of invasion pipe, using the quick-assembly type couplings. The line, at least for the present, will be laid on top of the ground. This is being done in the interest of speed in getting the line laid, and to provide an outlet for crude until further exploratory work more closely determines the productive ability of the new field or fields, after which a line of ample size can then be laid in the conventional manner.

However incomplete the picture still may be on the ultimate size or productive ability of the new area, it nevertheless is believed by persons familiar with developments that the Cuyama discovery is of great importance. Although much of the valley undoubtedly will prove to be unfavorable for accumulation of petroleum, nevertheless, the throwing-open of a 600- or 700-square mile area to intensive search for oil is likely to bring forth other fields, and probably will stimulate activity in surrounding or bordering areas. In fact, leasing currently is reported to be going on at an increasing rate in the Carrizo Plain area, an elongated sedimentary basin lying to the northwest of Cuyama Valley.

Inasmuch as California currently is producing oil at a near-maximum rate, with the peak expected sometime in 1948-49, the discovery of a new oil field in a province hitherto considered to be of minor importance, is a development of paramount significance to the state.

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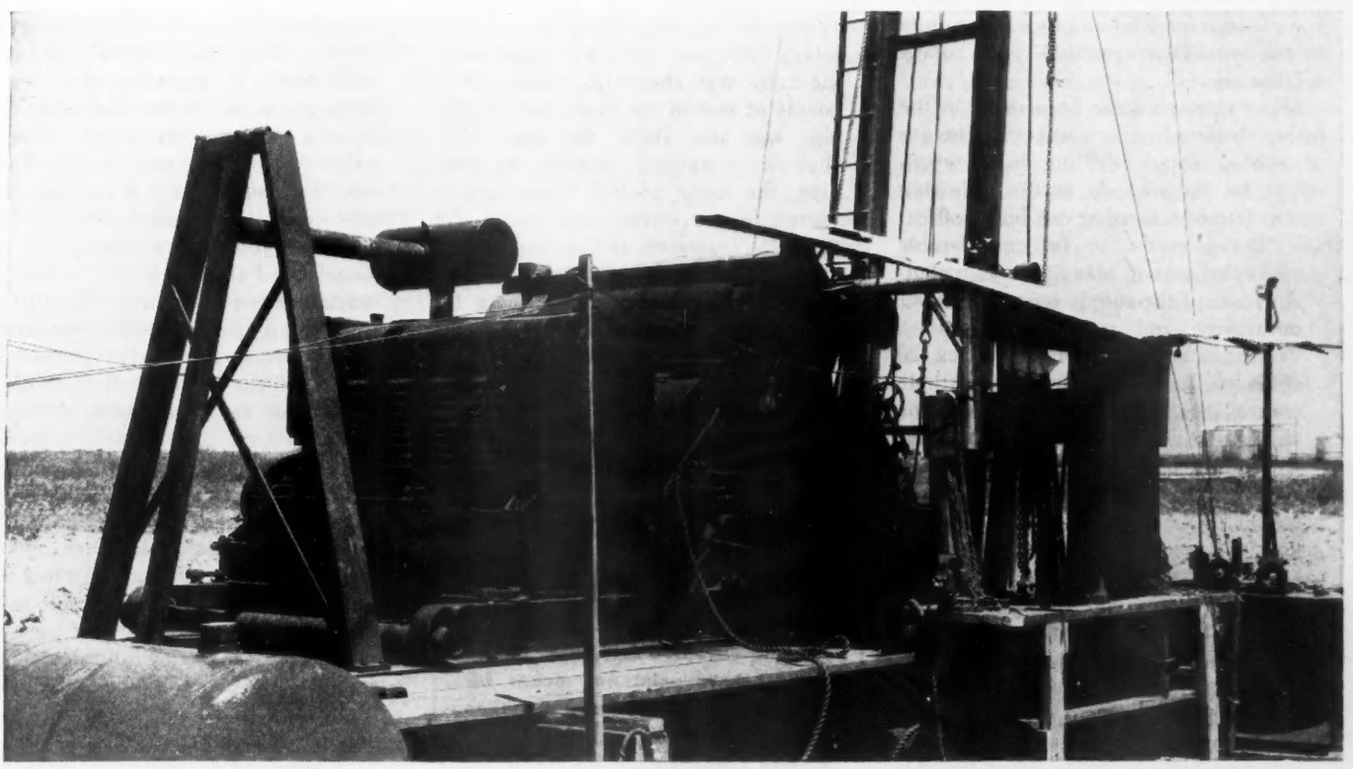
J. P. Gibbins, doing business in Midland, Tex., as Mobile, Inc., gets all of these from a Cardwell Model R spudder powered with a Model HP-600 Cummins Diesel. This firm uses economical Cummins Power for the important job of "drilling in." Mobile, Inc., one of the largest independent well servicing contractors in the West Texas area, operates nearly 80 well servicing units.



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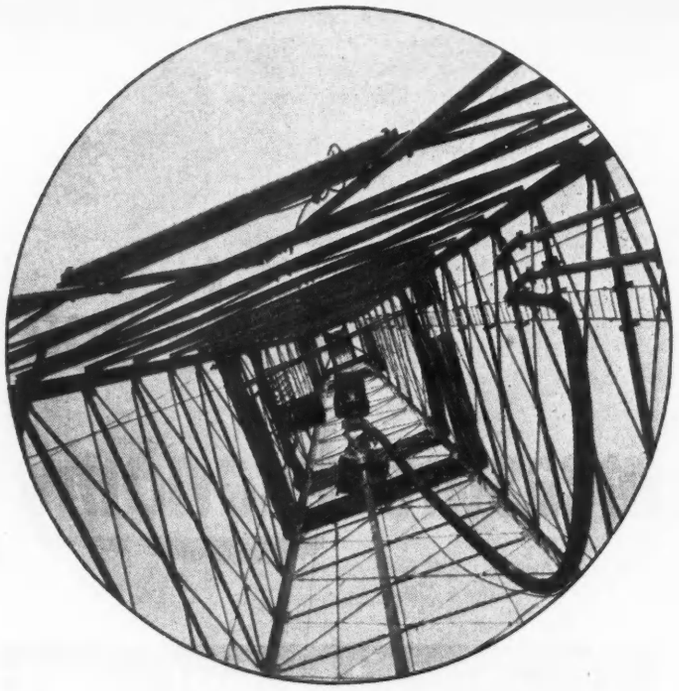
E-x-t-e-n-d-i-n-g Rig Hose Service



By C. A. FRANKLIN, JR., and P. J. BREDEN
New York Belting and Packing Company

IN THE ninth edition, dated July, 1944, the booklet entitled "API Specifications for Rotary Drilling Equipment," paragraph 83, entitled "Gooseneck Angle on Rotary Swivels," states: "The recommended angle between the center-lines of the swivel and the outer end of the gooseneck is 15 degrees." It further states this was adopted as a recommended practice at San Francisco in November, 1941.

This recommendation was one of the first major changes which allowed for the better drape of rubber rotary drilling hose, allowing for longer hose life of one of the most vital and important units to the successful operation of a rotary drilling rig.

Many changes have been made in the rotary drilling industry affecting the use of rubber rotary drilling hose which might be summed up in the following recent letter received at our home office:

"There seems to be considerable confusion among many people, including some of the supply boys, regarding mousehole and rathole connections. To explain this I must go back 20 years to the time I first saw rathole connections being made in the pine woods of Arkansas on a rotary rig that would now be termed a coffee grinder.

"The rathole is a hole drilled at the corner of the derrick, or near the corner, and used for 'setting aside' the kelly with the swivel attached while adding a new joint of drill pipe or when pulling out the string. After the intervening operations to this conventional method are completed, the hook is swung over to engage the bail of the swivel, and the swivel with the attached kelly is pulled from the rathole and raised to a point where the bottom of the kelly is just above the top of the newly added piece of drill pipe which now is just slightly above the rotary table. The connection is then made, the slips removed, and drilling continues.

"The first time I ever saw any method being used to add a joint of drill pipe, other than what the conventional methods were, was at El Dorado, Ark. While drilling was in progress a length of drill pipe was pulled into the derrick by means of the catline, lowered into the rathole, a place previously reserved for the kelly joint. When the kelly was made down to the rotary table, the string was raised until the kelly was above the table, and a couple of feet of the first joint of drill pipe was also above the table. The slips were applied around the drill pipe, the kelly broken loose, and I waited to see where they would put the kelly, inasmuch as they had a joint of drill pipe in the kelly's rightful abode. There was much straining by the crew at the lower end of the kelly as they swung it over toward the tool joint of the drill pipe which was protruding from the rathole. After some jockeying they managed to get the threads together at this awkward angle, and by means of a chain tong made them tight enough to hold.

"When this had been accomplished the driller raised his blocks and the swivel, kelly and length of drill pipe which came up out of the rathole, all swung up in the derrick above the table. Remember, all these items were much shorter and lighter than they are today. The time required for making a new connection was cut in half, and in those days men used to brag about how much better time they were making because they were making rathole connections.

"How long this practice continued until someone conceived the idea of drilling a second hole directly in front of, and close to, the rotary table in which to house the next length of drill pipe, I do not know, but the term rathole connections continued . . . only now everyone knew that they no longer used the kelly rathole but the special drill pipe rathole. Everything went along fine until some time during recent years somebody decided he would call the special drill pipe rathole in front of the rotary table a mousehole.

"So, if they are making mousehole connections they are making rathole connections, and if they are making rathole connections they are making mousehole connections. And when they put the kelly aside in its rathole while they pull in a new length of pipe, attach it to the string and lower the string to the rotary table, as they still do in many parts of the country, they are just making connections.

"I urge you to verify my version of this as there is always the possibility

ROTARY HOSE is called upon to absorb high stresses in service. Any practice which adds unnecessarily to such loads results in shortened hose life and increased drilling costs. The authors here point out means for minimizing hose stresses and outline proper procedure to prevent premature breakdown.

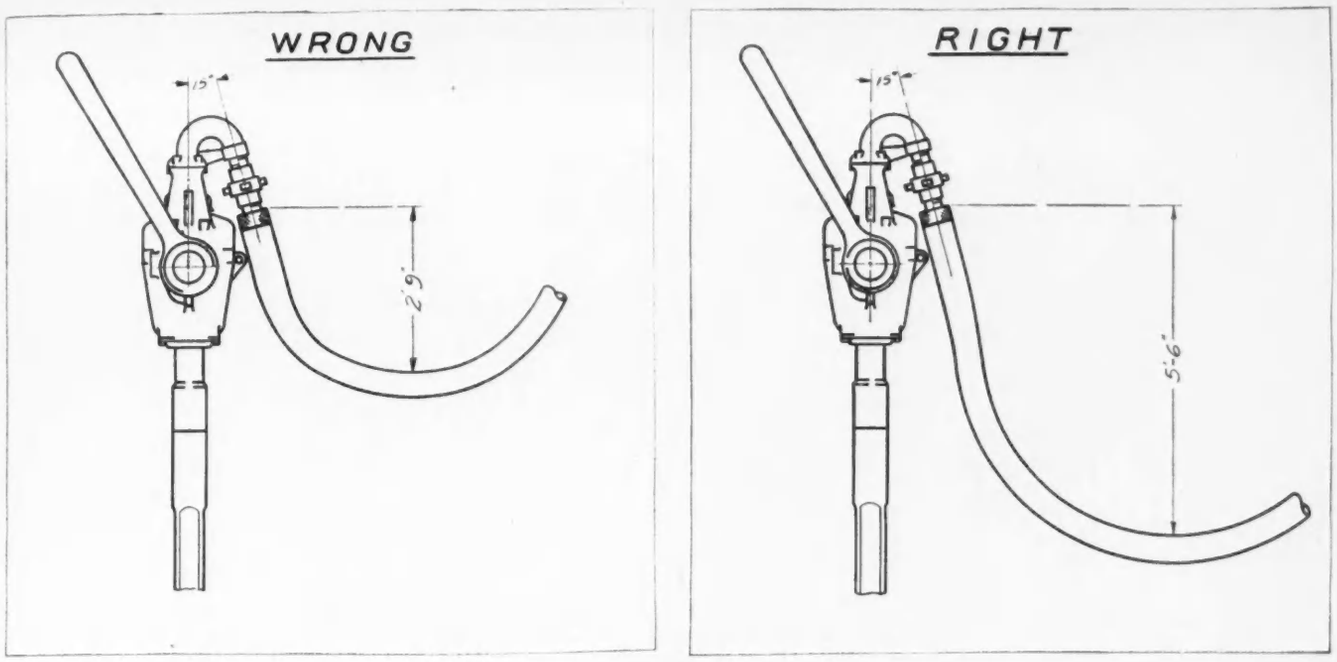


FIGURE 1

I could be wrong; and if you find a term for the procedure of not making rathole connections, I would like to hear it."

This letter, while it may sound confusing, does bring to light the need for clarification and enlightenment in the use of rubber rotary drilling hose under modern drilling methods where mousehole or rathole connections are being used.

Following the evolution of the mousehole connection as described in the above letter we look back to the days when 30- and 35-foot hose lengths were standard. Then came 40- and 45-foot lengths, then 50- and 55-foot lengths. Now 60-foot hose is available and is definitely recommended where mousehole or rathole connections are being made on a standard drilling derrick.

In making this type connection many drillers have gone to the use of a 50-foot or taller standpipe to allow for clearance of the tool string off the derrick floor without giving consideration to the proper ratio to hose length, resulting in severe swivel end strain to the hose (Figure 1).

Rubber rotary hose has been accepted as a flexible unit and being flexible has been expected to do almost the impossible in its operation, but when the potential power of the rotary rig is considered, it can be readily seen that certain safety factors must be provided to allow rubber rotary hose to give the full service life expected of it, and which it can deliver if given half a chance.

In making mousehole or rathole connections there are many factors involved requiring a proper relationship of standpipe height to hose length. The first is the length of the tool string, involving a joint of drill pipe with tool joint, kelly saver sub, kelly, kelly stop-cock, and the swivel. An average tool string using these components will measure approximately 85 feet. Then an allowance for floor clearance or run-by must be added. This gives the swivel a high position of approximately 90 feet and a low position of approximately seven feet between which extremes the rotary hose acts as a flexible connection. This requires the maintenance of a proper ratio between the length of the tool string to the hose length to the standpipe height.

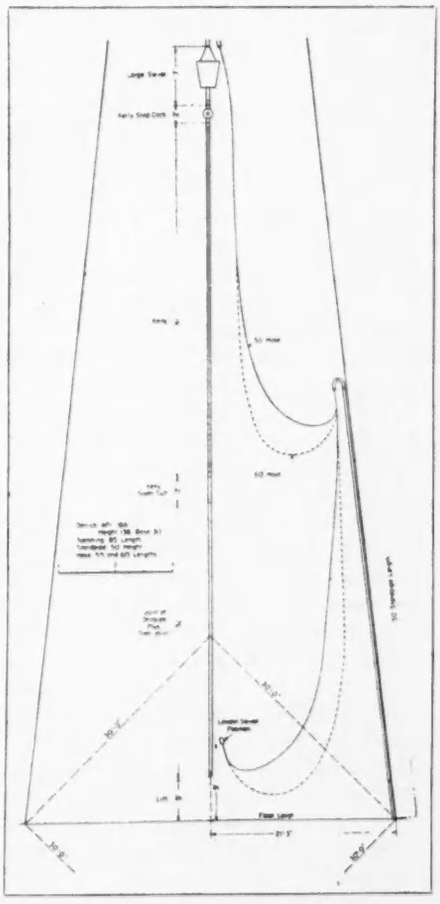


FIGURE 2. Relationship of standpipe height to rotary hose length on standard drilling derricks.

Now consider the makeup of a rubber rotary hose. The body is of duck plies with wire reinforcing plies designed for maximum pressure resistance. Steel fittings are built in the ends, causing rigidity at that point for a certain distance. To prevent any kink or strain directly against this rigid member, reinforcements are included in the hose ends to divert this strain from the nipple proper. This means that a specific footage of the hose is not flexible as we know rubber. Therefore, allowances must be made for this non-flexible portion of the hose and the normal bending radius of the hose proper when hanging in the rig.

This can be accomplished best by being guided by the following rules which are applicable to standard drilling derricks having a base dimension of 24 feet to 32 feet.

Where Mousehole or Rathole Connections Are Not Being Made

1. Standpipe height should be ten feet shorter than rotary hose length. This will prevent strain and kink at swivel end of hose and prevent loosening up of the fitting; i.e., 55-foot rotary hose, 45-foot standpipe—60-foot rotary hose, 50-foot standpipe.

2. Use exactly 50 feet of standpipe height and nothing shorter than a 60-foot rotary hose. Using a maximum five-foot lift this will eliminate straining and kinking either the standpipe end or swivel end of the hose as well as preventing loosening up of the fittings.

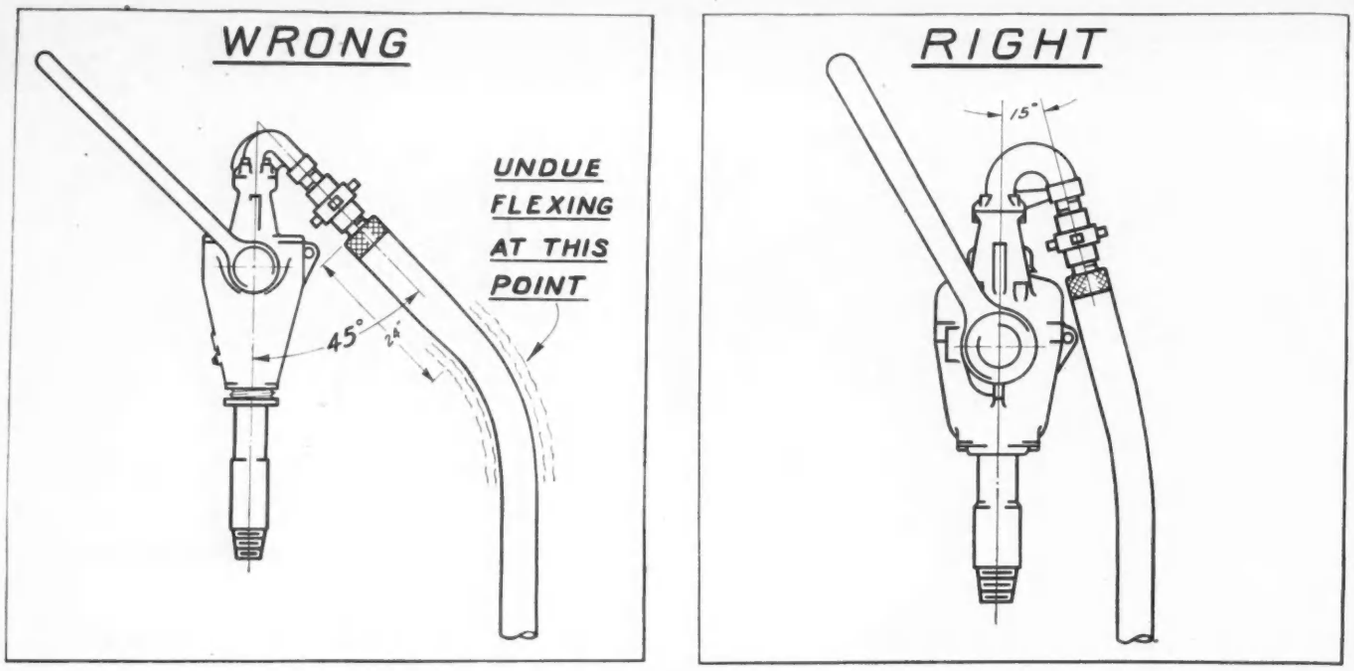


FIGURE 3

3. Fifty feet of standpipe height and 60 feet of rotary hose will accommodate a maximum string of 85 feet and allow for a maximum lift of five feet of the 85-foot string or a shorter string with the difference available for more lift and therefore more safety against straining and kinking at the standpipe end (Figure 2).

4. Summing up rules 2 and 3 we arrive at the following formula: Footage of tool string plus five feet for lift of string plus 20 feet equal total footage of rotary hose and standpipe needed. Always figure the standpipe height at ten feet shorter than hose length. (Note: On 35-foot base derricks standpipe height should be 12 feet shorter than hose length.)

By following the above rules, and in using care and keeping the run-by five feet or under when pulling the new joint of pipe from the mousehole or rathole, the driller is providing the maximum safety to his hose, thus keeping his rig expense and shutdown time to an absolute minimum so far as his mud line is concerned.

There are other factors, of course, which play an important part in the life of rotary hose.

As previously mentioned, the recommended angle of the gooseneck on the swivel is 15 degrees off perpendicular. This allows for proper hang of hose during the drilling operation. The old 45-degree gooseneck, of which there are still many in use, makes the hose follow that same angle when coming off the gooseneck, placing a sharp kink or bend at the end of the hose where the hose "end reinforcement" ends. Constant flexing at this point during drilling operations will eventually cause the hose to break down at this point long before its normal life expectancy (Figure 3).

This same principle is applicable to the standpipe gooseneck and here a long sweeping 160- or 180-degree ell is recommended, which provides the same straight hang of the hose as recommended on the swivel gooseneck.

Bracing Standpipe

In some cases rotary hose is being subjected to a continuous whipping or jumping action. This condition causes early fatigue and the breaking down of the pressure wires in the hose, which naturally leads to failure at the fatigued point. Various suggestions and ideas have been advanced for the adequate bracing of the standpipe when it is subjected to continuous vibration due to pulsation in the line. This is a particular problem when the standpipe is not adjacent to the derrick leg where it can be bolted to the angle-iron leg. Despite such bracing, successful as it might be, the pulsations will still carry through to the hose, causing the whipping and jumping action referred to above. To provide full service a suitable surge chamber should be installed to relieve the condition, or if a surge chamber is being used, it should be checked to see that its working parts are functioning and it is properly charged. Another cause of this whipping action can be traced to leaking rod packing at the fluid end of the slush pump.

In the construction of rubber rotary hose the wire plies are laid up at a predetermined scientific angle to give the maximum of pressure resistance. Alternate plies of wire are spiralled in opposite directions for balance. Again, considering rubber rotary hose as a flexible member, some operators have for some reason or other placed a back twist in the hose during their drilling operations. This practice might give the operator a solution to his immediate need, but consider the manner in which the wire plies are applied and it will be seen how a back twist in a hose will tighten one wire ply and loosen the other to a point where the pressure resistance of one ply is lost, resulting in unbalanced pressure strain. Aside from this, a back twist makes the hose stiff and eliminates the flexibility that is built into it. Such use has a definite tendency to weaken the inner structure of the hose again resulting in earlier failure and higher maintenance cost. As a help to drillers to determine whether a hose is hanging straight in the rig, a straight longitudinal color stripe is placed on the hose and where this stripe shows any indication of a twist while hanging in the rig the union should be loosened allowing the hose to unwind and find its natural position.

Finally, care is required in the handling of rubber rotary drilling hose when installing in the rig and moving it from one location to another. In rigging up it is recommended that rubber rotary hose be taken out of the crate by hand, laying it out in a straight line before pulling it up with a catline. In this manner the possibility of throwing a kink in the hose is eliminated. Care should be used to see that in any case the hose is not snagged on any sharp projection or equipment. When moving, use a carrier for rotary hose and do not allow the hose to be handled with a winch line. Especially do not permit it to be hung

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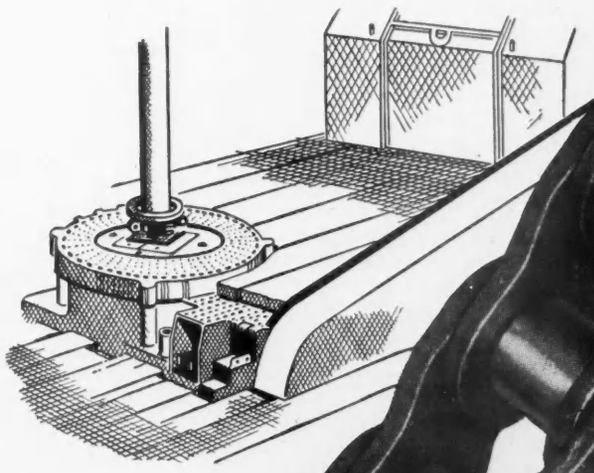

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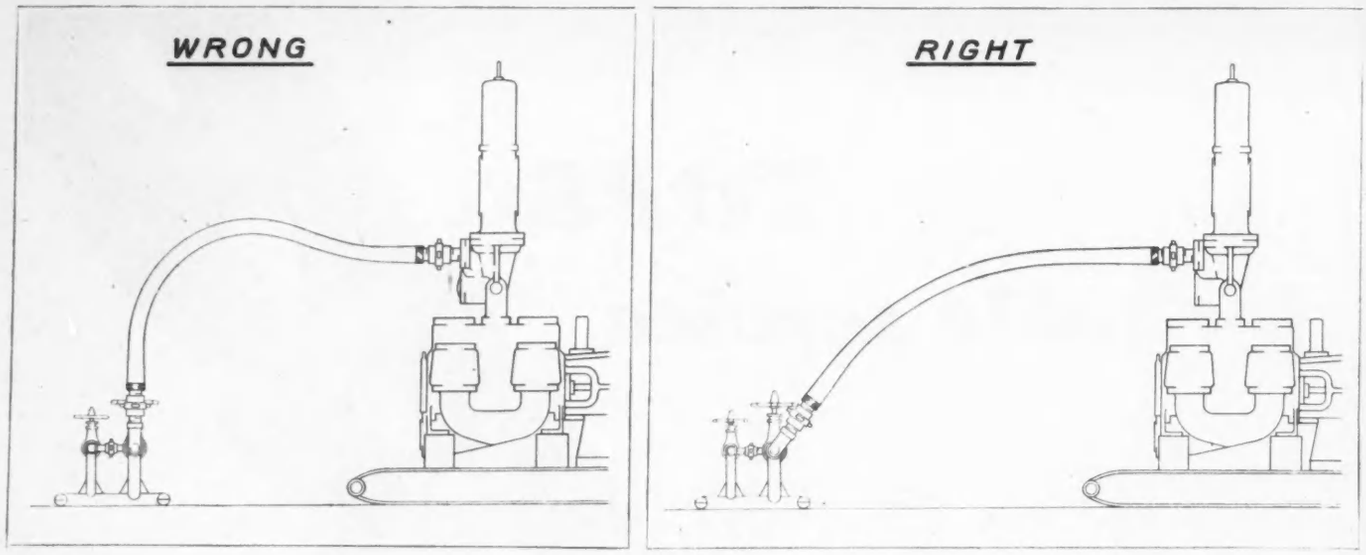


FIGURE 4

from the ginpoles of a truck. If this is done the weight of the hose will be suspended at one point. The result will be kinking and breaking down of the hose with premature failure following. Such kinking may not be immediately noticeable but failure will possibly develop several wells later without any supposed justification due to mishandling.

On the modern rig there are other flexible rubber units which provide for quick rigging up of the slush pump in particular. One of the newer of these flexible units is the slush pump discharge hose which eliminates pipe fittings and the necessity of true alignment of the pump to the mud pressure lines.

Here again, however, this unit, like rotary hose, is considered a completely flexible member and a cure-all for any misalignment. As in rotary hose there are certain non-flexible units built in rubber slush pump discharge hose and for peak efficiency where the mud line manifold is located directly behind the the slush pumps it should be far enough back to allow the slush pump discharge hose to have a long sweeping arc. The hose must not be crowded into a small space. To do so causes a sharp bend in it which spreads the pressure resisting wires apart, thus eliminating its ability to hold mud pressure (Figure 4).

Where the mud line manifold is located to one side of the slush pump, set the long sweeping ell coming off the pump at a 45-degree angle pointing down. This takes the flexing and strain off the end of the slush pump discharge hose. If the ell is allowed to come off the pump at a sharper angle, flexing and strain on the end of the hose is increased and service from the hose is greatly decreased (Figure 5).

Move the slush pump discharge hose in the rotary hose carrier to avoid kinking and mashing.

One of the older flexible units on the rig is the slush pump suction hose which has already proven its worth. To secure full service, support for the suction line should be so placed to carry the weight of the line. This prevents a sharp bend off the end of the bandless built-in nipple in the suction hose and heavy flexing of the hose at that point. The suction line should not be raised to any height which would cause a sharp upward bend of the suction hose at the end attached to the slush pump. Such a bend will increase flexing of the hose at that point and thus prevent it from giving full service.

In conclusion, there has been adopted a safety color code for drilling rigs; by the same token a safety formula should be adopted by each driller for the care and use of flexible rubber hose connections for drilling rigs. It is hoped that the features brought out in this article will be found to be of considerable help toward increasing the service life of the three types of hose discussed, all of which will help to reduce that important factor of shutdown time and its resultant cost.

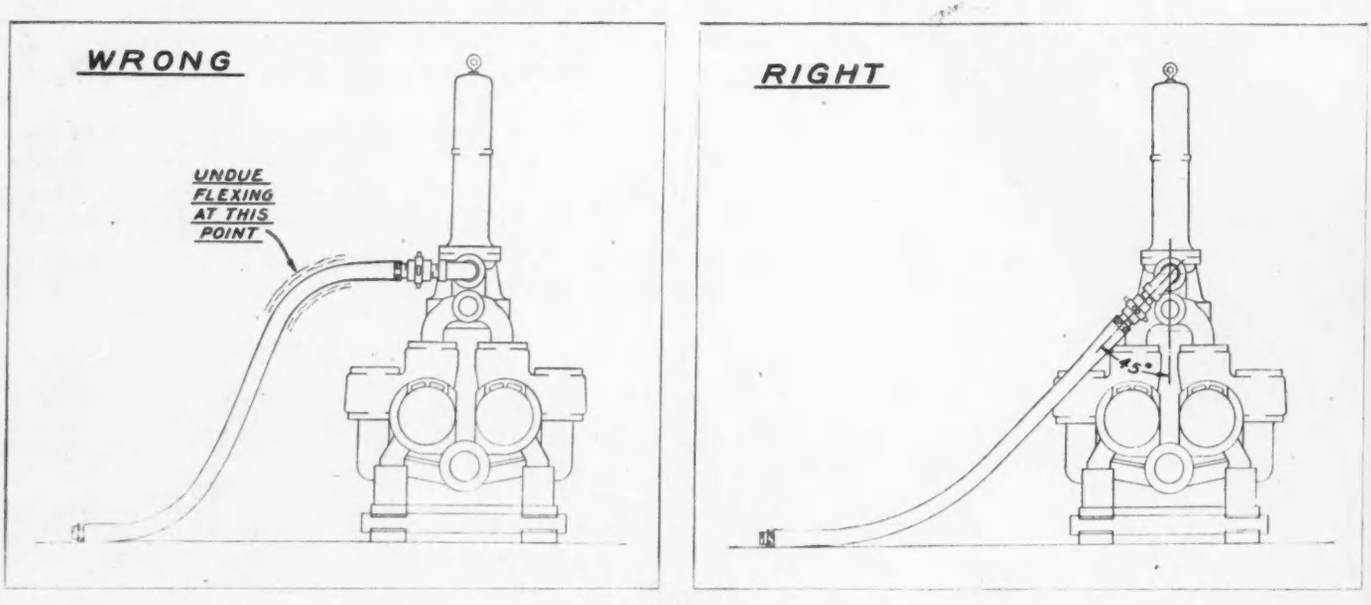
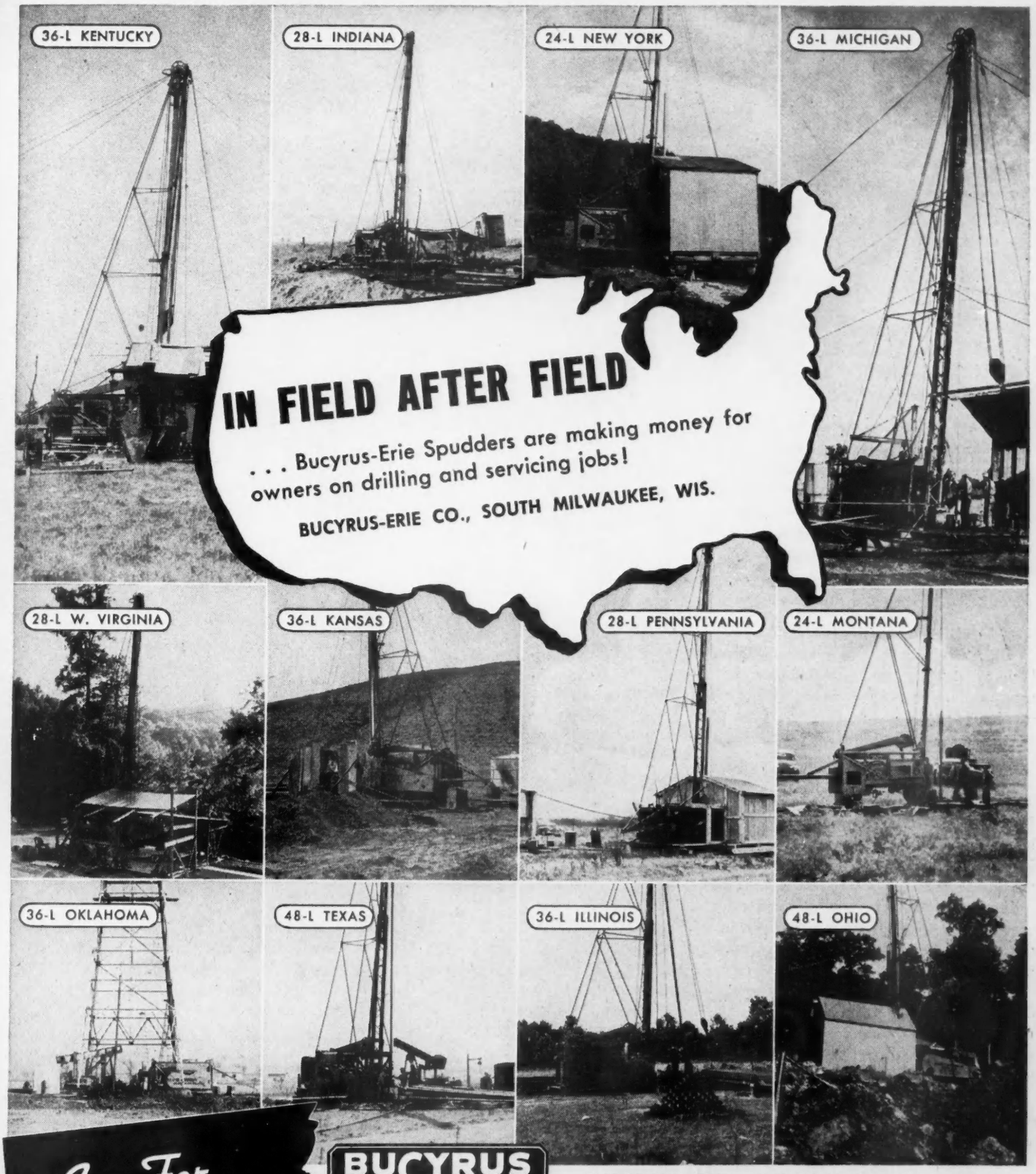


FIGURE 5



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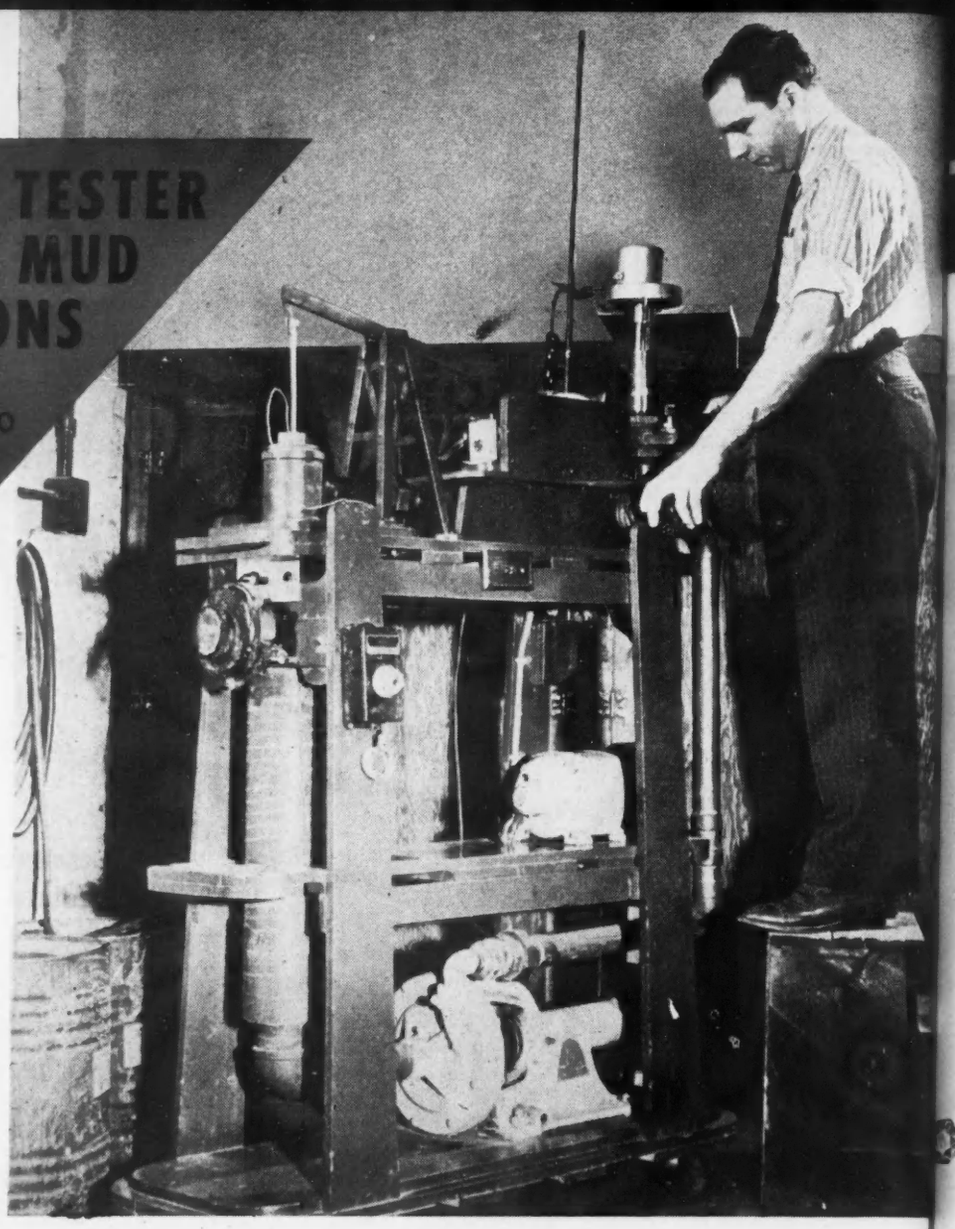
LABORATORY TESTER SIMULATES MUD CONDITIONS

by
N. E. MARTELLO
Calgon, Inc.



AN APPARATUS designed to more accurately evaluate the effects of chemical treatment on mud is described. Designed to conduct tests approximating field conditions, the apparatus will permit engineers to study mud characteristics more effectively in the laboratory.

Norman E. Martello, who developed the drilling mud test apparatus, demonstrates the taking of viscosity readings.

WHAT effect does a given chemical have on drilling mud? In the past, laboratory workers have used tests that involve treating and testing the mud at room temperatures, or treating the mud, then heating it in sealed containers, and finally testing it at room temperatures.

Both kinds of testing overlook the fact that in well drilling, the mud is being concurrently agitated and heated for long periods, and these conditions accelerate changes in the clays and the ordinary treating chemicals by complex reactions involving base-exchange, hydration or dehydration, and adsorption or desorption,

In short, results obtained in the laboratory, where by ordinary methods the mud is tested in quiescent state, in many instances differ sharply from results in actual drilling.

Needless to say, efficient performance of the mud is vital to economical and effective well drilling. The cost of the mud itself, while substantial, is not by any means the whole story of its importance. Modern drilling methods would be impossible without mud of low viscosity—it could not do its essential job of bringing up the chips or cuttings from the hole, "police" or hold back the oftentimes tremendous gas pressures encountered, and help to lubricate the drill bit.

The writer has devised a machine that permits close evaluation of the effects of chemical treatment on mud. The apparatus, although inexpensive and comparatively simple to construct, permits the treating and heating of mud while it is being circulated. Chemicals can be added to the mud at any desired stage in the test periods, and their effects studied in about the same way as in actual field practice. Contaminating materials may be added to the original mud to determine their effects when encountered in the field.

The viscosity of the mud also can be checked periodically without its being removed from the apparatus. Thus no sampling of mud is required and it is not necessary to curtail the test periods to permit withdrawal of mud. A reservoir of mud is not necessary because

About the Author

NORMAN E. MARTELLO has been associated with Calgon, Inc., Pittsburgh, since 1938 and has devoted his time principally to field research and the development of materials to be used in treating drilling mud. While attending Carnegie Institute of Technology several years ago he served as engineer of a field investigation into the effects of insoluble phosphates on drilling mud and at that time originated the idea of a mud recirculator. He is registered in Pennsylvania as a professional chemical engineer and is a member of the AIME and the American Chemical Society.

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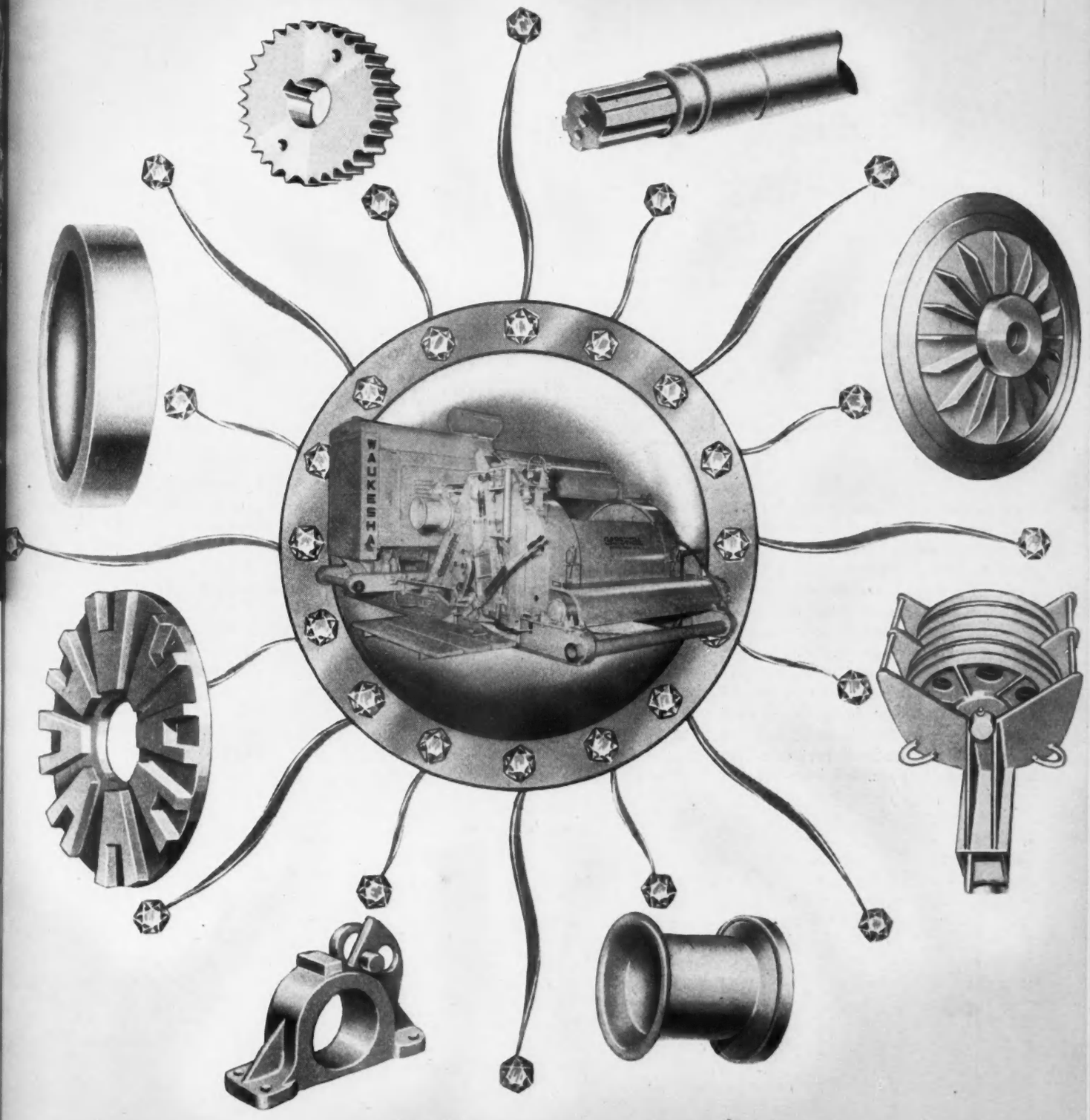

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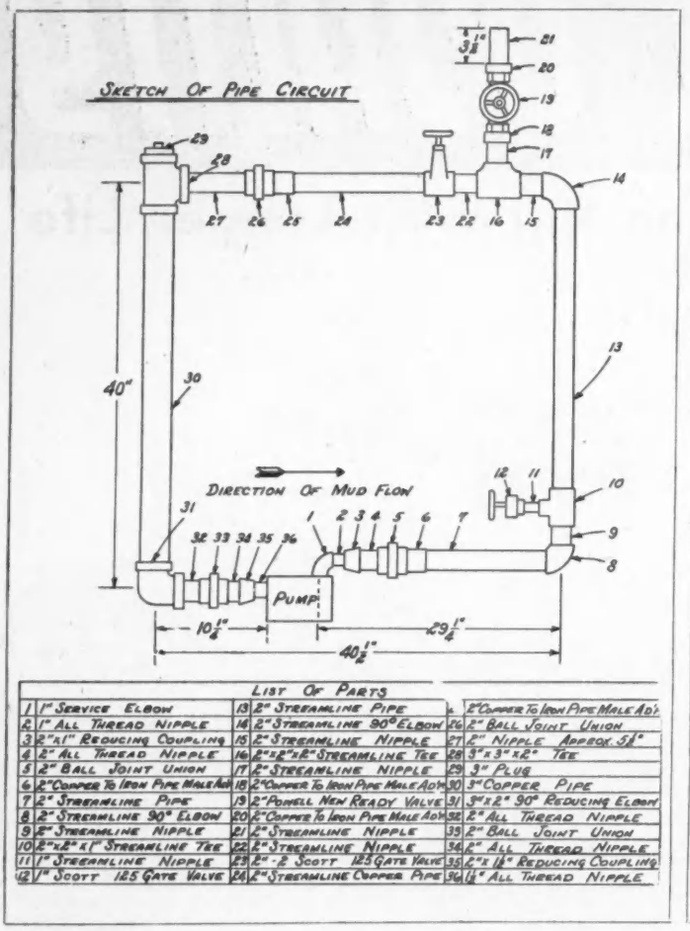
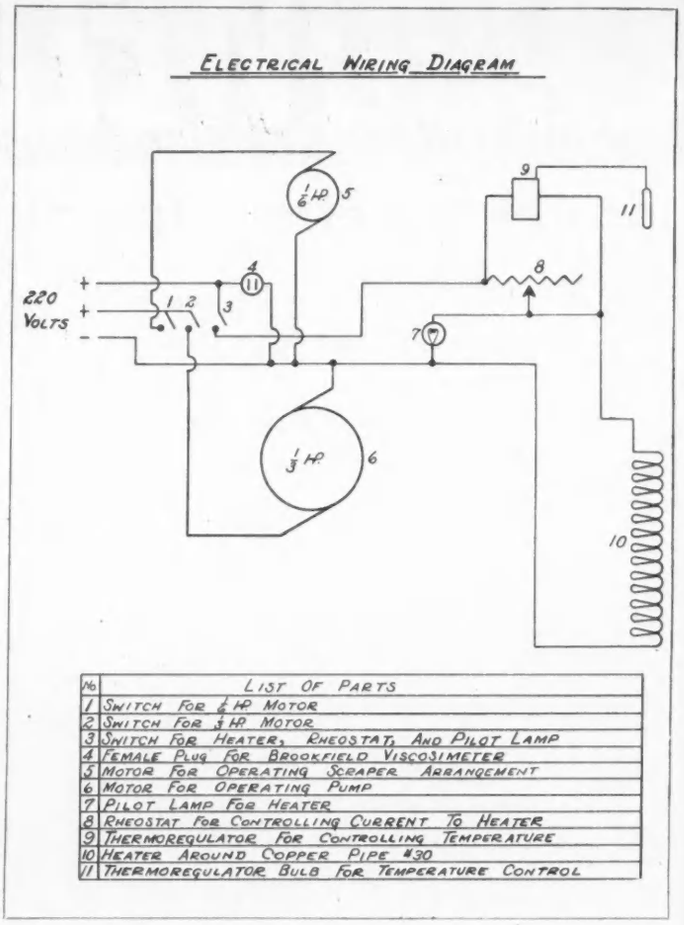


List Of Parts			
1	1" Service Elbow	13	2" Streamline Pipe
2	1" All Thread Nipple	14	2" Streamline 90° Elbow
3	2"x1" Reducing Coupling	15	2" Streamline Nipple
4	2" All Thread Nipple	16	2"x2"x2" Streamline Tee
5	2" Ball Joint Union	17	2" Streamline Nipple
6	2" Copper To Iron Pipe Male Adp.	18	2" Copper To Iron Pipe Male Adp.
7	2" Streamline Pipe	19	2" Powell New Ready Valve
8	2" Streamline 90° Elbow	20	2" Copper To Iron Pipe Male Adp.
9	2" Streamline Nipple	21	2" Streamline Nipple
10	2"x2"x1" Streamline Tee	22	2" Streamline Nipple
11	1" Streamline Nipple	23	2" - 2 Scott 125 Gate Valve
12	1" Scott 125 Gate Valve	24	2" Streamline Copper Pipe
		26	2" Ball Joint Union
		27	2" Nipple Approx. 5½"
		28	3"x3"x2" Tee
		29	3" Plug
		30	3" Copper Pipe
		31	3"x2" 90° Reducing Elbow
		32	2" All Thread Nipple
		33	2" Ball Joint Union
		34	2" All Thread Nipple
		35	2"x1¼" Reducing Coupling
		36	1¼" All Thread Nipple



No.	List Of Parts
1	Switch For ⅙ HP Motor
2	Switch For ⅓ HP Motor
3	Switch For Heaters, Rheostat, And Pilot Lamp
4	Female Plug For Brookfield Viscosimeter
5	Motor For Operating Scraper Arrangement
6	Motor For Operating Pump
7	Pilot Lamp For Heater
8	Rheostat For Controlling Current To Heater
9	Thermoregulator For Controlling Temperature
10	Heater Around Copper Pipe #30
11	Thermoregulator Bulb For Temperature Control

the apparatus is a completely enclosed system. Moreover, if there were a reservoir, there would be a possibility of channeling, which would lead to unequal treatment and incomplete circulation of the mud stream.

The apparatus, which is designated as a recirculator, consists of three principal sections: a large centrifugal pump for circulating the mud, a heated section through which the mud flows, and a valve arrangement for trapping mud samples for viscosity checking. Sticking of hot mud on the inner surface of the heated pipe is eliminated by a scraper that traverses the whole heated section. Capacity of the system is about 2.6 gallons. The mud is circulated at a rate of about 20 gallons a minute.

The mud system is of copper and brass to minimize corrosion, and the entire apparatus is mounted on a platform supported by dolly wheels to facilitate movement.

For cleaning, the circulating system can be separated at two union connections, one on the top horizontal run and the other on the bottom horizontal run of the pipe sections.

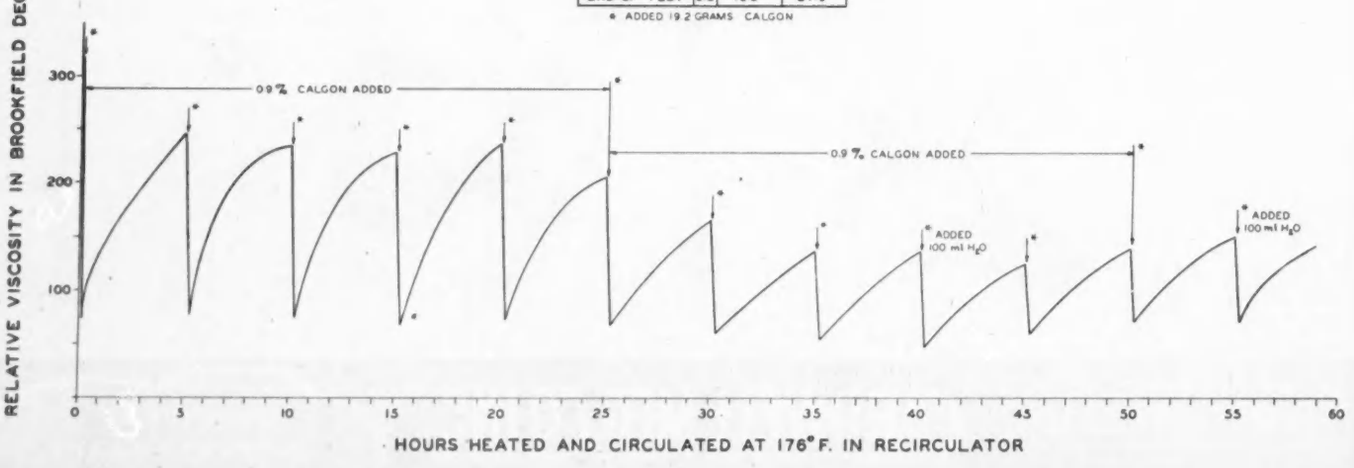
For measurement of the mud viscosity, a Brookfield viscosimeter equipped with variable speed drive is employed. Spindle rotation rates of six, 12, 30, and 60 revolutions per minute can be obtained by turning a switching device. The instrument is operated with a synchronous motor and comes completely standardized. It has a 1½ inch guard around the spindle which provides sufficient clearance for immersing into the mud cup.

After the apparatus has been cleaned and assembled, and a weighed quantity of mud poured into the apparatus through the top of the heated pipe, the

EFFECT OF CALGON ON A SALT CUT MUD IN A RECIRCULATOR TEST

	pH	Density Lb./Gal.	Solids Content
START OF TEST	7.6	9.8	20.0
END OF TEST	6.5	10.0	21.9

* ADDED 19.2 GRAMS CALGON



scraper is inserted in the heated pipe and the plug screwed over the top. The scraper is then connected to the walking beam by the coupling (C), and the thermo-regulator and thermometer are placed in wells located on the plug.

Circulation of the mud, with heating and scraping, is started.

When the mud temperature has risen to 176° F., viscosity measurements are obtained as follows: With the valve (19) open, the valve (23) is slowly closed. Mud flow is throttled and the mud rises into the cup above the valve (19). When the mud is within an inch of the top of the cup the quick-acting valve (19) is closed and the rotating spindle of the viscosimeter immersed to the proper level in the mud. Viscosity readings are taken and recorded.

The valve (23) and then the valve (19) are completely opened, permitting the mud to flow back into the recirculating system. Valve (19) then is closed, the cup and the viscosimeter are cleaned and ready for reuse.

A small mud sample now is removed through valve (12) and retained for comparison with a sample to be taken at the end of the test.

Chemical treatment now may be started. The scraper is stopped in "up" position and the plug (A) removed. Weighed chemical in dry form is inserted, followed by about 100 milliliters water to rinse out the chemical container. The plug is replaced and the scraper restarted. After five minutes, viscosity readings again are taken.

Circulation and heating of the mud are continued, with viscosity readings being taken ½ hour after chemical addition and at one-hour intervals thereafter, up to five hours. Chemical is again fed and viscosity readings taken at ¼, ½ and one-hour intervals after the feeding of reagent.

These five-hour cycles are carried on throughout the test, which may last for at least several days if the chemical used continues to treat the mud satisfactorily. If this is not the case, the mud will thicken up to such a point that the test must be stopped. This time cycle was adopted because the mud thickened up sufficiently in five hours to make the feeding of chemical desirable.

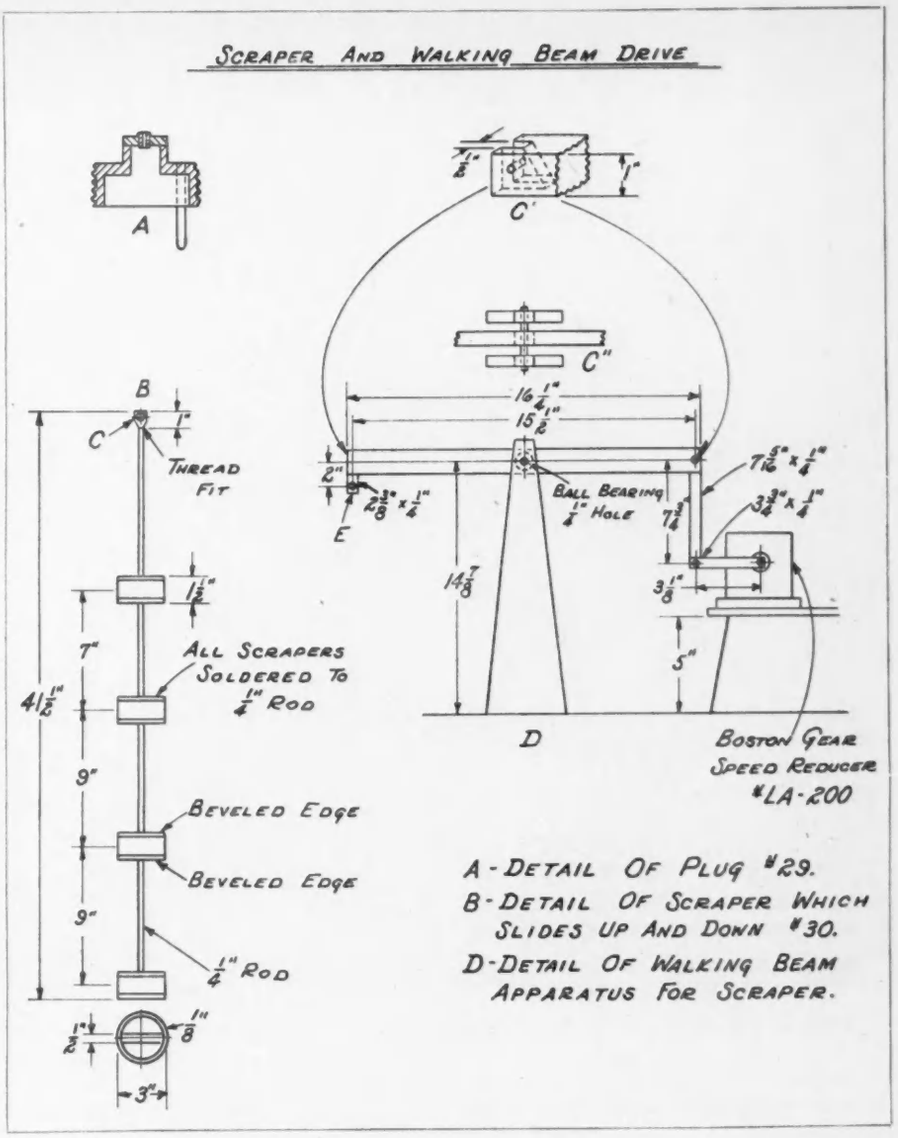
Several times during each test 100 ml. portions of water are added to help make up for the loss due to evaporation from around the scraper rod. These water additions have very little effect on lowering the viscosity of the mud. At the end of the test a sample of mud is again withdrawn through the valve (12) and saved. Both mud samples, one from the beginning and the other from the end of the test, are checked for pH, mud weight, and solids content. In this way the changes in these mud properties can be followed. Obviously, this pilot unit permits considerable latitude in the method of testing, particularly with respect to the mud temperature employed and the frequency of chemical additions. Also, by means of the four-speed arrangement on the viscosimeter, apparent viscosities may be determined at any one of four rates of shear. With this viscosimeter it is possible to follow the rate of gel of the mud by taking readings with every revolution of the spindle over a short period, at 6 rpm and 12 rpm.

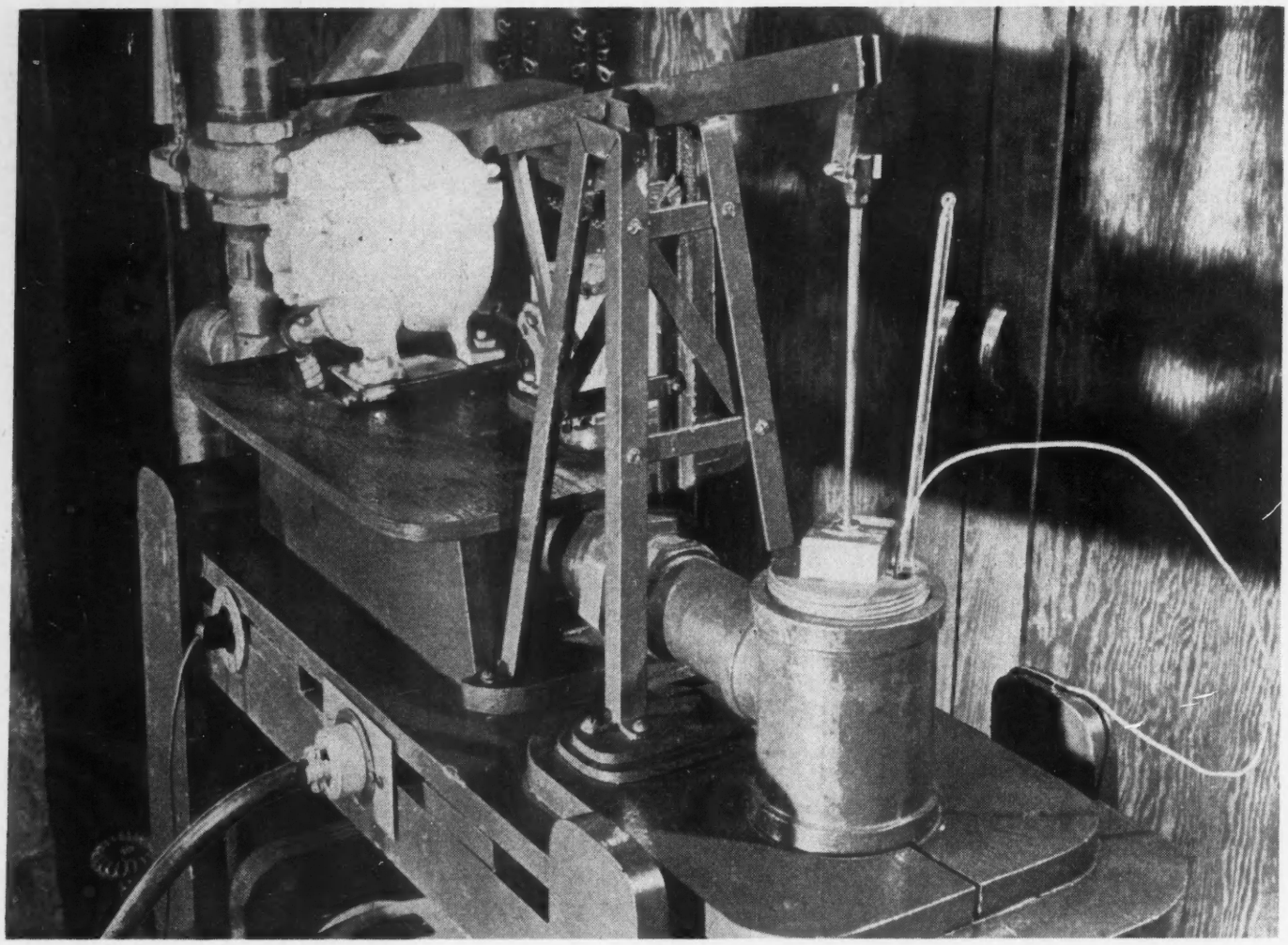
As previously indicated the chart on page 102 shows a plot of the values obtained by treating 12,800 grams of a mixed mud composed of 0.5 percent bentonite, 9.5 percent ordinary drilling mud clay, 9.5 percent barite, and 0.35 percent sodium chloride with the chemical reagent over the entire testing period. The concentrations of all ingredients were based on the total mud weight.

The pH was 7.6 at the start of the test and 6.5 at the end. No alkali agent was added during testing. The drop in pH was presumably due to partial rehydration of the chemical reagent or to sequestration of calcium ions from the water and clay.

Both the density and the solids content increased a little from start to finish, the density rising from 9.8 pounds per gallon to 10.0 pounds per gallon, with the solids increasing from 20.0 percent to 21.9 percent. These values indicate that the mud lost water by evaporation during the 59-hour test period.

The initial addition of 19.2 grams of chemical reagent which is equivalent to 0.15 percent of the total mud weight, markedly decreased the viscosity of the original mud. As heating and circulation were continued, the mud thickened up. After five hours, a second increment again reduced the viscosity, which subsequently rose again as heating and circulation were continued. After a total of about 1.0 percent had been added, the mud began to show progressively less increase in viscosity during the successive five-hour periods. Even after 2 percent had been added, the increase in viscosity during each cycle was small, indicating that considerably more chem-





Closeup view of the scraper assembly actuating mechanism

ical could have been added before the original viscosity conditions would be reached.

TABLE 1

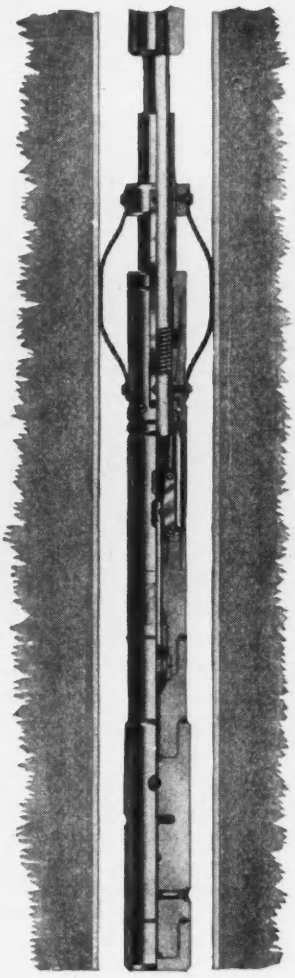
Construction Details

1. Heater Construction.
   Copper pipe (No. 30) is covered with several layers of asbestos paper. Chromel C wire is then wound over the paper. Wire covers full length of pipe. One piece of magnesium pipe covering is then placed over the wire. The covering is taped on and then painted.
2. Scraper Construction.
   The individual scrapers are made of brass tubing beveled at both ends. They are attached to the brass ¼-inch rod by copper strips. The copper strips are bolted to the scrapers and then the strips are fixed to the rod by soldering. The coupling at the top of the scraper rod is threaded so that it can be removed when the plug A is slipped over the rod during assembling.
3. Lifting Apparatus.
   A 2¼-inch chain-driven sprocket is attached to the motor and a three-inch sprocket is attached to the speed reducer. The motor and speed reducer are placed 7¾ inches apart from center to center of the sprockets. A light chain is used to drive the reducer. The scraper makes about 6½ complete strokes per minute while operating.
4. Pipe Apparatus.
   All pipe and fittings are either brass or copper to eliminate corrosion. Only the pump casting is iron. All streamline pipe and fittings are soldered together. Threaded pipe and fittings are screwed together.
5. Framework Construction.
   All framework for support of component parts is of wood and the whole is mounted on dolly wheels to facilitate movement.
6. Pump Apparatus.
   The ⅓-horsepower motor has a V belt four-inch pulley attached to the shaft, and the pump has a six-inch pulley attached to the shaft. A ½-inch V belt is used to transmit power to the pump.
7. Plug.
   The plug is drilled on the top and a brass bearing is soldered into the plug to guide the scraper rod as it slides up and down. On the side of the plug, two wells are soldered in, one for the thermometer and the other for the thermo-regulator.

TABLE 2

Equipment Description

1. Centrifugal pump with bronze impeller.
2. Gear speed reducer.
3. One-sixth hp continuous duty motor 110V.-AC.
4. One-third hp continuous duty motor 110V.-AC.
5. Thermo-regulator.
6. Heater wound from Chromel C ribbon wire 1/16-inch wide .504 ohm/ft. AWG 25. Heater draws 5.5 amperes. Wattage 643. Approx. 42 ft. wire used.

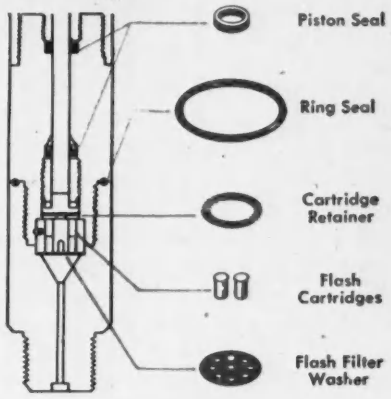


A JOHNSTON SHOOT-N-TEST GUN PERFORATOR

Uses only these few expendable supplies...

THE FEW EXPENDABLE SUPPLIES illustrated are *all* that are needed for each Johnston Gun Perforating Job. After cleaning and drying the Firing Head and Perforating Gun Section, these few parts are easily replaced during normal reassembly. Individual Firing Chambers of each 4, 5 or 6-shot Perforating Gun Section are hand-loaded and need only a light portable hydraulic capper to assure precision alignment of the retaining cups over the firing chambers.

The Firing Head of the Johnston Gun Perforator requires no special tools or fixtures to effect complete reassembly. The Sealing Rings, Piston Seals, Flash Washers and two 32-calibre cartridges are negligible in cost and can be replaced right on the rig floor. Belly Springs need be replaced only when friction-worn beyond their ability to hold tension. Tension can be re-set before each run.



FIRING HEAD EXPENDABLE PARTS

Before you purchase any Gun Perforating Equipment check the outstanding advantages offered by the Johnston All Purpose Gun Perforator!

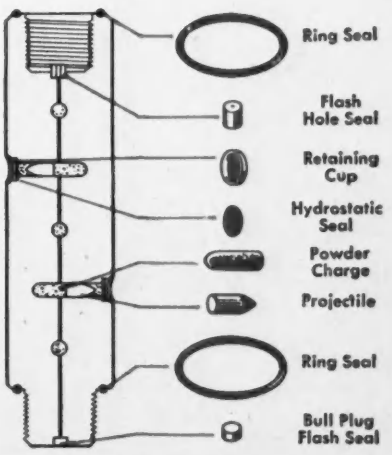
PERFORATE AND TEST IN ONE TRIP! To *both* perforate casing and test formation in one trip of tubing or drill string you simply connect the Johnston "SHOOT-N-TEST" Gun Perforator to your regular Johnston Tester and Pressure Recorder. First you fire the Gun Perforator and then take a formation sample immediately after perforating casing.

***SAFE* GUN PERFORATOR OPERATION!** The Johnston Gun Perforator affords utmost safety in all phases of gun perforator operation. It will not fire until subjected to both in-the-hole hydrostatic pressure and top-hole manipulation by the driller.

PORTABILITY AND FLEXIBILITY! The Johnston Gun Perforator can be transported in the back of your regular field car! And *after* arriving at well location, you attach only the number of 4, 5 or 6-shot Perforating Gun Sections needed for that particular job.

EXACT POSITIONING IN PRODUCING ZONE! Accurate placement of the Johnston Gun Perforator opposite the zone selected for perforating is easily determined by your own pipe-in-the-hole tally. No rigging up of special measuring devices is necessary.

POSITIVE FIRE OF ALL PROJECTILES! The safe, fool-proof hydrostatic firing principle of the Johnston Gun Perforator Firing Head coupled with the flash-hole design of the Perforating Gun Sections insures positive fire of all projectiles.



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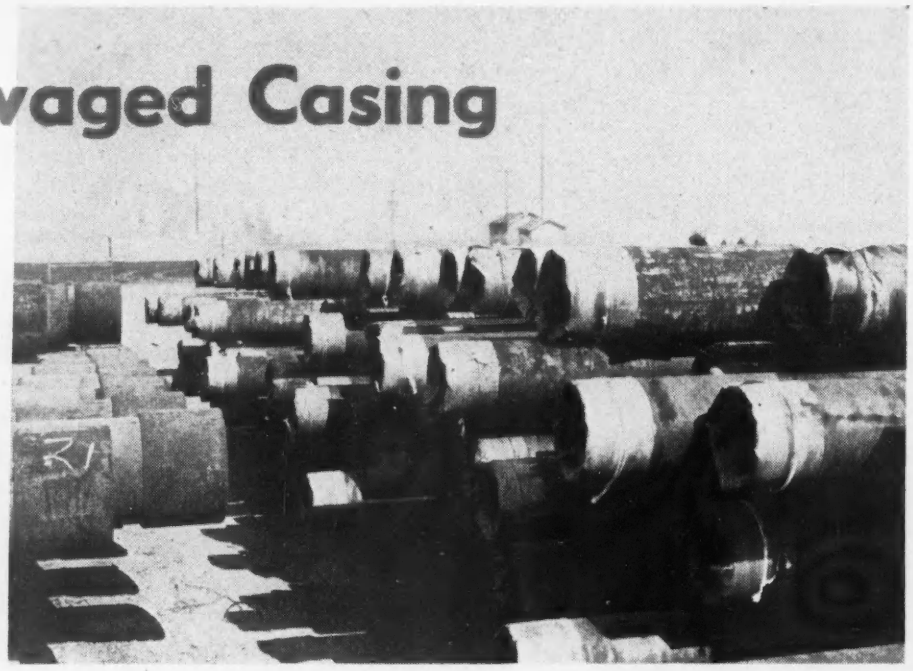
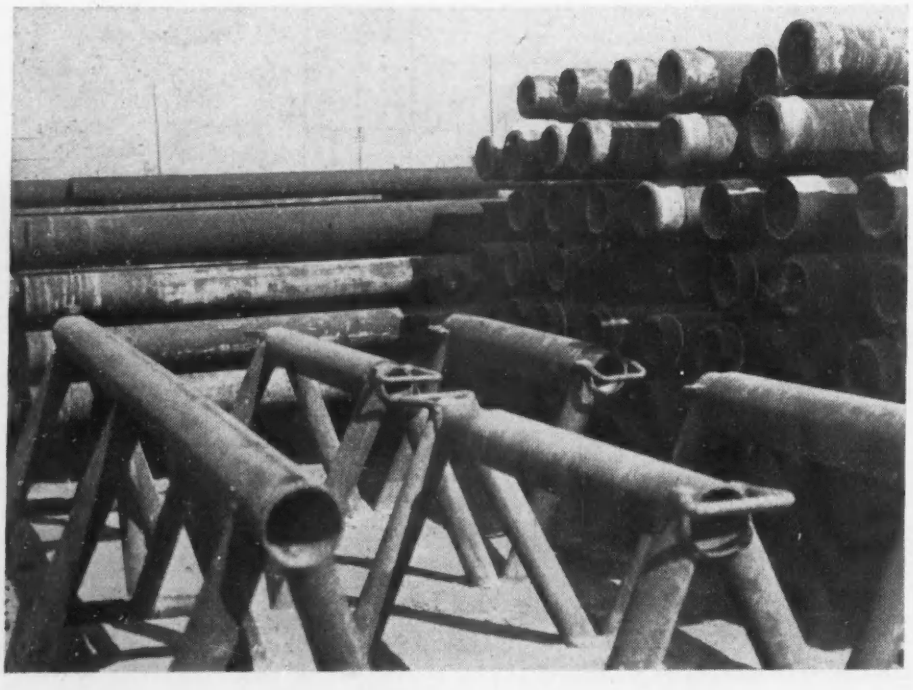
Care of Salvaged Casing



As protection for casing, a coating of rust preventive is applied to the threaded ends and covered with tarred building paper secured with tightly wrapped cord as a substitute for metal protectors.

WHEN salvaging casing from an abandoned well, or after pulling a string of pipe not essential to good production practice, the care given the material in the storage yard can materially affect the re-use, whether when being run into shallow wells or strung again for pipe lines. One oil company sees to it that all pipe worth stacking on racks for re-use is fully prepared at the time of being placed on the rack, so that when moved to the point of use, it can be put together with a minimum amount of lost time.

Obviously, the pipe is graded as to weight, size, and condition as it comes into the storage yard, but as it comes in, each joint is carefully inspected and damaged threads are reconditioned, either by cutting away the original threaded end and running new ones or by simply cleaning the old threads so they will run freely into the collars again. Loading and unloading can mean the difference between a potentially good joint of pipe and one ready for the junk pile, depending upon how it is handled when rolling from the truck. The company supplied combination extension horses with hand holds at either end so the men may move them easily from one point to another. One pair of legs is welded to a horizontal piece of smooth pipe with open ends, and the other pair of legs is welded to a second piece of pipe, but smaller in diameter, so that the horse can be lengthened without weakening it, because the pipe is heavy enough to take the load placed upon it. These horses are placed beside the truck so that the pipe will not whip around when unloading, thereby keeping joints straight so they may be used again without additional workover.

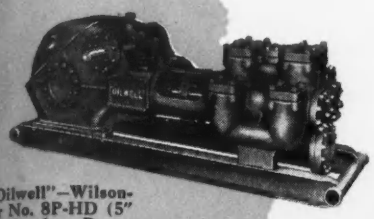


Portable horses designed to be used for moving pipe from one rack to another, or from truck to rack, or from the rack to a truck, as the case may be.

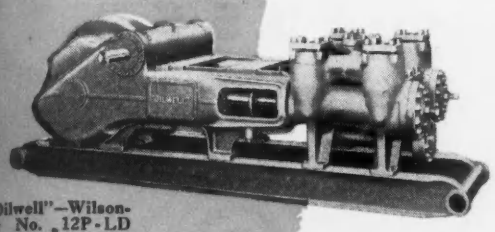
Threaded ends are cleaned with wire brushes, if in potential good condition, coated with a rust preventive, and wrapped with tarred building paper which is tightly rolled against the ends and secured with heavy cord. Cord is used in preference to wire because it may be broken without the use of snips, and again, if a threaded end should come in contact with another piece of metal, the cord will not offer resistance which could mar an otherwise perfect thread.

To break out fittings and remove collars from pipe to be replaced with collars which are not damaged, a rack is provided for the pipe vise. This rack is made of drill pipe and is not intended to be moved frequently. "A" frame legs are welded to each end of a long joint of pipe, diagonally braced and fitted with a timber footing to which the leg ends are bolted. Heavy "V" blocks are clamped at points to divide the horizontal member in three sections so that a piece of pipe clamped in the chain vise can be held securely even when several men are on the business end of a pair of heavy chain tongs. When following through with the various prescribed operations in the yard where pipe is reconditioned, the material is racked ready to be hauled to a location and can be made up without additional inspection.

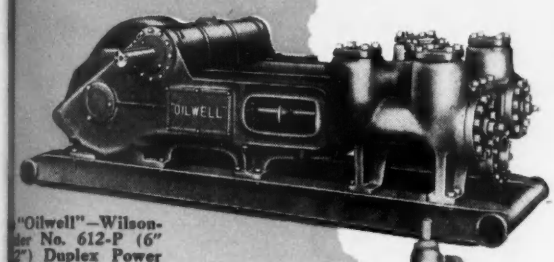
5 dependable PUMPS for portable rigs



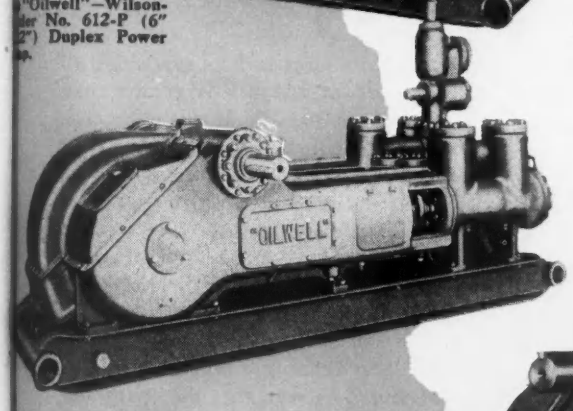
"Oilwell"—Wilson-Snyder No. 8P-HD (5" x 8") Duplex Power Pump.



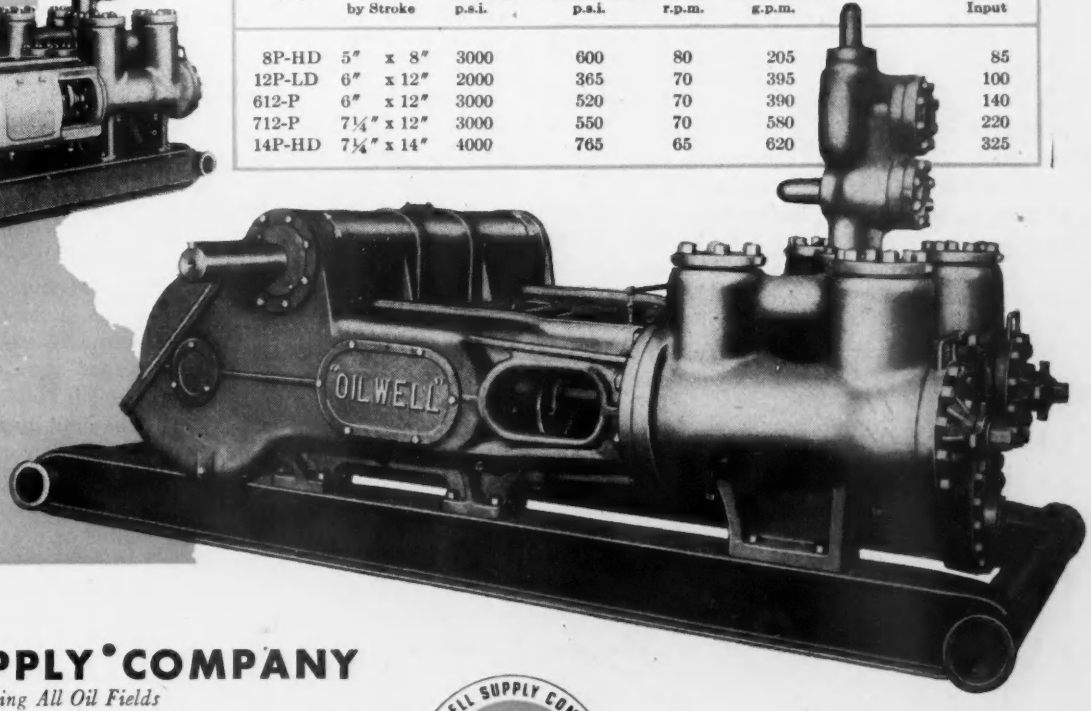
"Oilwell"—Wilson-Snyder No. 12P-LD (6" x 12") Duplex Power Pump.



"Oilwell"—Wilson-Snyder No. 612-P (6" x 12") Duplex Power Pump.



"Oilwell"—Wilson-Snyder No. 712-P (7¼" x 12") Duplex Power Pump.



The "Oilwell"—Wilson-Snyder No. 14P-HD (7¼" x 14") Duplex Power Pump.

THERE is an "Oilwell"—Wilson-Snyder Duplex Power Pump of the right size and capacity for every drilling requirement. The 5 pumps illustrated are recommended for portable rigs where the drilling depths are moderate.

Outstanding advantages of these pumps include: (1) single helical gears which are reversible to compensate for wear, (2) crankshaft and pinion shaft are made of heat-treated alloy steel and mounted in adjustable tapered roller bearings, (3) large streamlined passages assure minimum restriction to mud flow and adequately large valves are provided for high speed operation, (4) bearings, pinion, main gear, and crossheads are lubricated by a combination oilbath and positive flow lubrication system, (5) crosshead-pin roller bearings, diaphragm stuffing boxes, and fluid-end stuffing boxes are pressure grease-lubricated, (6) DI-HARD fluid cylinder liners, (7) HI-HARD piston rods having A.P.I. taper, (8) alloy steel fluid valves and seats, (9) flexible mud-baffle discs, (10) all pumps are equipped with packed-off liners and (11) all pumps are mounted on a heavy-duty steel skid assembly.

A complete line of Accessories including suction strainers, valves, working tools and types of packing is available.

BRIEF SPECIFICATIONS

Pump	Max. Liner Size by Stroke	Hydrostatic Test Press. —Discharge p.s.i.	Working Press. With Full-size Liners p.s.i.	Recom. Speed r.p.m.	Theoretical Displacement at Max. R.P.M. g.p.m.	Rec. Brake H.P. Input
8P-HD	5" x 8"	3000	600	80	205	85
12P-LD	6" x 12"	2000	365	70	395	100
612-P	6" x 12"	3000	520	70	390	140
712-P	7¼" x 12"	3000	550	70	580	220
14P-HD	7¼" x 14"	4000	765	65	620	325

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Electrical Logging Developments in the U. S. S. R.

Part 6

By HUBERT GUYOD
Well Logging Consultant, Houston

WHILE the partial-curve-matching procedure outlined in the preceding article can be applied successfully to the interpretation of electric logs for resistivity distributions of the type

$$R > R_1 > R_m$$

it is obvious that the same method fails for other distributions. Figure 40, for example, shows the three-medium departure curve [2, 10, 1]. Referring to the two-medium departure chart calculated for the same type of electrode arrangement (see Figure 2, Part 1 of this series, WORLD OIL, December, 1947), it is readily seen that arc XY of Figure 40 cannot possibly be matched with the extreme left portion of two-medium curves. The same remark can probably be made for many other resistivity distribution of the type

$$R < R_1.$$

No data are available at present on the limit of applicability of the partial-curve-matching method, and at the present time the following remarks should therefore be applied only to the cases for which

$$R > R_1 > R_m.$$

1. During the discussion of the equivalent medium chart of Figure 38 (WORLD OIL, June, 1948), it has been assumed that a single chart could be used for interpreting the electric logs made for all distributions for which R is greater than R_1. There is no proof that this is correct, and it may be found later that two or more charts are necessary to cover the usual resistivity range. This, however, does not introduce any real complication.

2. Although most of the properties of the equivalent medium are not known at present, a few of them are nevertheless obvious from an inspection of the equivalent medium chart of Figure 38. In particular, it can be seen that the characteristics of the equivalent medium are equal, or nearly equal, to those of the mud invaded zone when there is considerable mud invasion, or when the resistivity of the mud invaded zone is relatively small. In other words when either one, or both, of the foregoing conditions is fulfilled, the influence of the mud column is negligible or nearly negligible. This is almost obvious offhand, but the limits of validity of the foregoing remark could not be determined a-priori. A correct equivalent medium chart would give precise information on this point.

3. Other interesting data on the characteristics of the equivalent medium can undoubtedly be obtained from an analytical investigation of the problem. This medium is probably a wholly fictitious thing, though a convenient concept for the petroleum engineer. Whatever the meaning of this medium, the interpretation method derived therefrom seems to be entirely trustworthy.

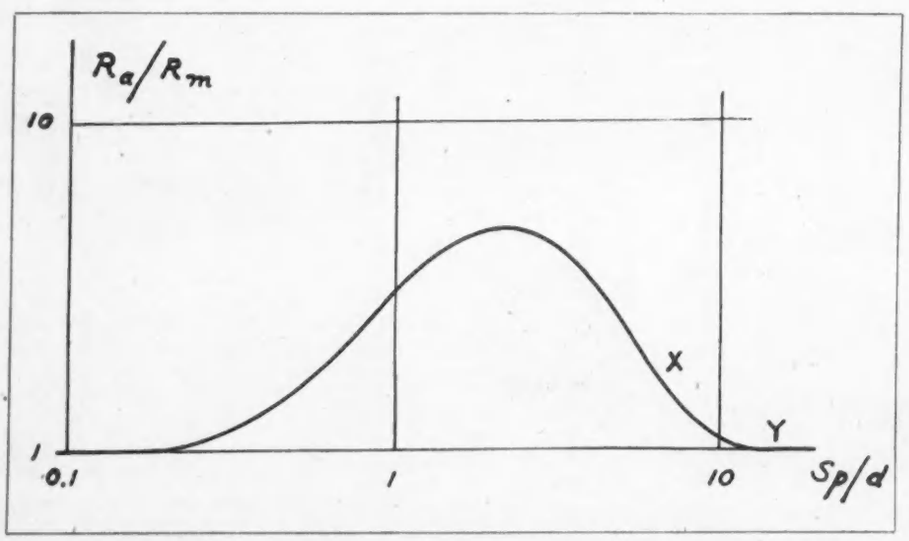

FIGURE 40. Resistivity departure curve (2, 10, 1) for three-electrode arrangement.

While the preceding articles have

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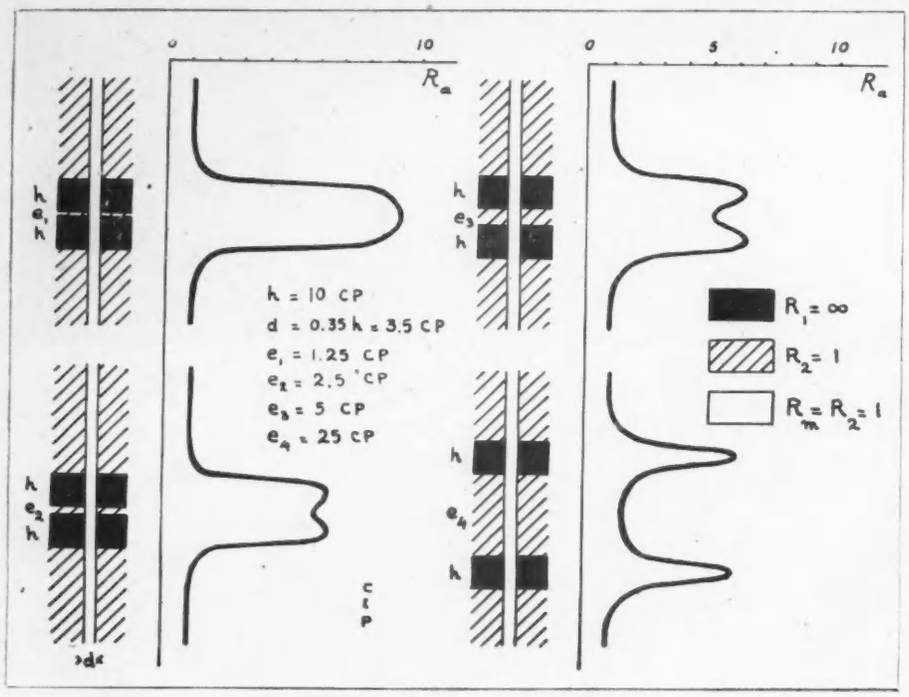
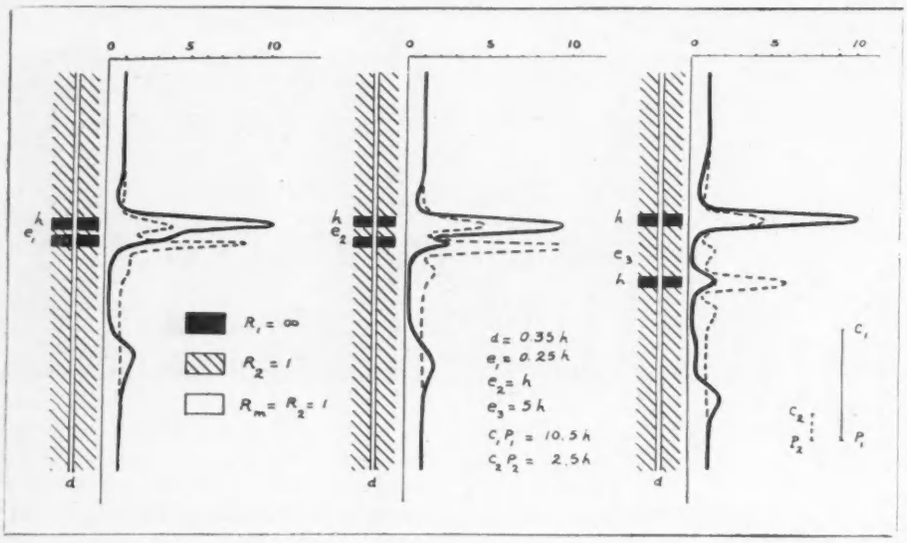
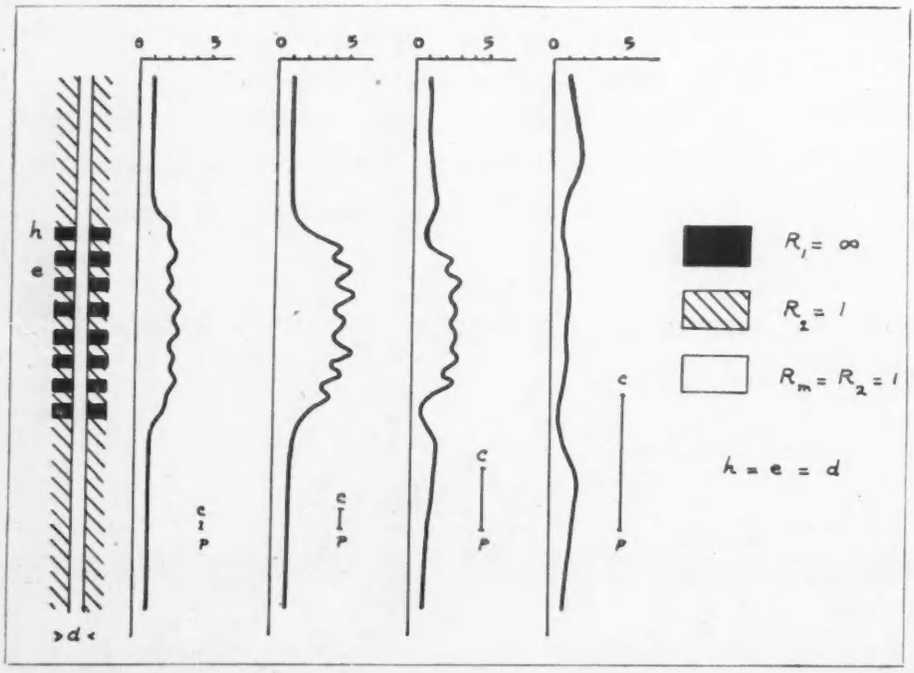






pointed out that electric logs can be used for estimating a few reservoir characteristics, they have shown also that such determinations require considerable interpretative data, most of which are not available at the present time. The more important of these are listed below with some of the writer's comments.

1. ACCURATE TWO-MEDIUM DEPARTURE CHARTS. The charts available at present do not seem to be accurate enough for an efficient application of the partial-curve-matching method. It would be desirable also to have data for very short electrode spacings.

2. ACCURATE THREE-MEDIUM DEPARTURE CHARTS. Many of these are needed for establishing the equivalent medium charts. The number available at present for resistivity distributions of the type

$$R > R_1 > R_m$$

is much too small to give accurate data.

3. RANGE OF EQUIVALENCE. The equivalence principle is known to apply to resistivity distributions of the type

$$R = R_m$$

It is felt that it applies also to other distributions, although this has not been proved as yet. Some work need therefore be done to ascertain the exact range where the equivalence principle is applicable. This is important because only outside of this range is a log interpretation unique.

4. EFFECT OF BED THICKNESS. The departure charts discussed in this series are applicable only to thick beds, namely to beds whose thickness equals several times the longest electrode spacing used. While the Russian authors have investigated the bed thickness effect, it does not seem that real satisfactory data were available in the U.S.S.R. at the time Dakhnov's book went to press. Considerable work need therefore be done. From the meager and scattered information at hand at present it seems that, when the data will be available, the influence of the bed thickness can be taken into account with a very small number of charts.

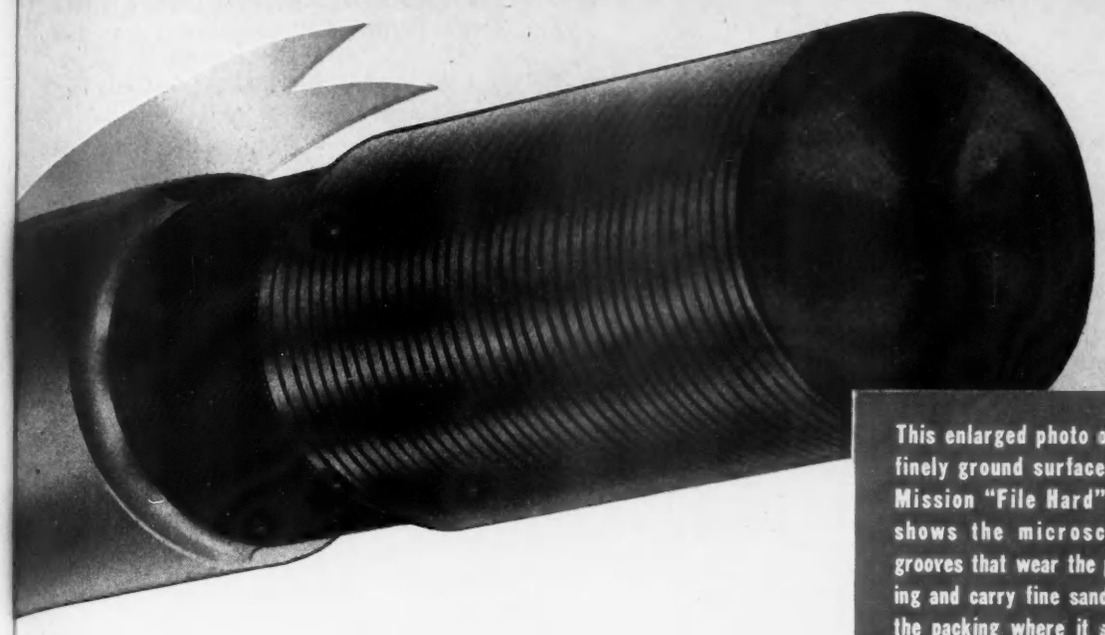
5. EFFECT OF ELECTRODE SIZE AND SHAPE. This effect is

FIGURE 41 (Top). Two-electrode resistivity graphs showing effect of a conductive streak in a resistant bed. Scale model data. (From Dakhnov, 1941.)

FIGURE 42 (Center). Three-electrode resistivity graphs showing effect of a conductive streak in a resistant bed. Scale model data. (From Dakhnov, 1941.)

FIGURE 43 (Bottom). Two-electrode resistivity graphs in alternation of resistant and conductive beds. Scale model data. (From Dakhnov, 1941.)

IN MISSION RODS



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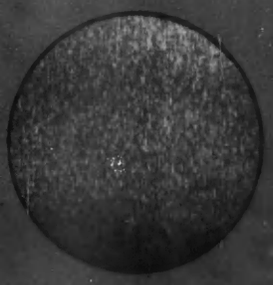
Mission "File Hard" Piston Rods are now being "Satin Finished" to give an ultra-smooth surface to the entire rod—threads, taper and wearing surface.

This new surface gives many benefits—the most important being longer rod and packing wear as explained in the photographs and drawings at right.

In addition, the satin smooth taper means better rod-to-piston fit. The result is less chance for washouts between rod and piston. The threads are satin-finished, too. This prevents galling of threads and, by smoothing out sharp corners in the thread roots, reduces stress concentration and chances for rod breakage.

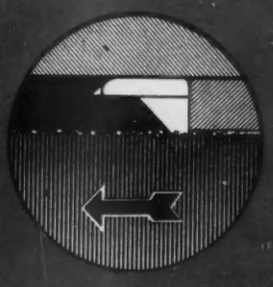
And you get these finer rods at no increase in price! This is just one more example of the leadership that has made Mission products the favorite of leading majors and independents all over the world.

This enlarged photo of the finely ground surface of a Mission "File Hard" Rod shows the microscopic grooves that wear the packing and carry fine sand into the packing where it sticks and cuts the rod.

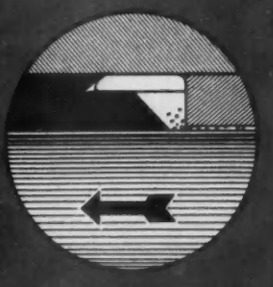


This enlarged photo shows the "Satin Finish" surface now supplied on Mission "File Hard" Rods. Notice the absence of sharp irregularities to wear the packing and catch sand.

This schematic drawing shows how sand is pulled into the packing by the ridged surface of a ground rod. These sand particles become imbedded in the packing and cut the rod.



Since the smooth surface of the Mission Satin Finish Rod does not carry sand into the packing, the rod wear from sand imbedded in the packing is considerably reduced.



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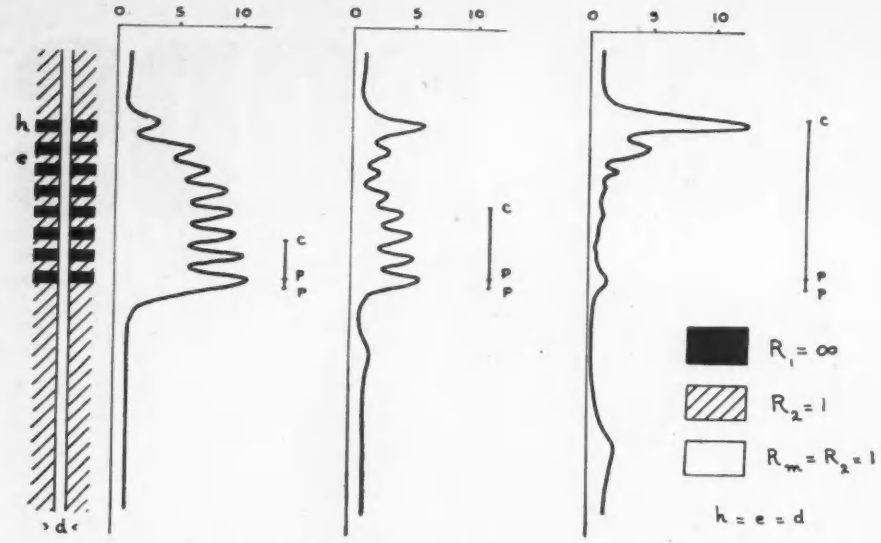


FIGURE 44. Three-electrode resistivity graphs in alternation of resistant and conductive beds. Scale model data. (From Dakhnov, 1941.)

greater than is generally realized. Therefore it need be carefully analyzed. An illustration of the influence of the electrode size will be presented below.

6. INTERPRETATIVE METHODS. The partial-curve-matching procedure is only one among several possible methods of interpretation. Its main advantage is simplicity. On the other hand, it is not universal. The principles of other methods are therefore being considered. It is hoped also that organizations interested in electrical logging will investigate extensively this important problem.

Adequate Logs Necessary

Success in interpreting geophysical measurements depends not only upon the availability of interpretation charts, but also upon adequate field data. This remark applies evidently to electrical logging also.

In electrical logging, the type and number of measurements have to be selected according to the method of interpretation used and also according to the type of reservoir being investigated. Electrode arrangements and spacings used successfully for a given reservoir may fail, and frequently will fail, when applied to the investigation of another reservoir, even if both reservoirs are penetrated by the same well. It is therefore undesirable to standardize electrode spacings in a given petroleum province. More exactly, it is permissible to run standard spacings in a well, but this

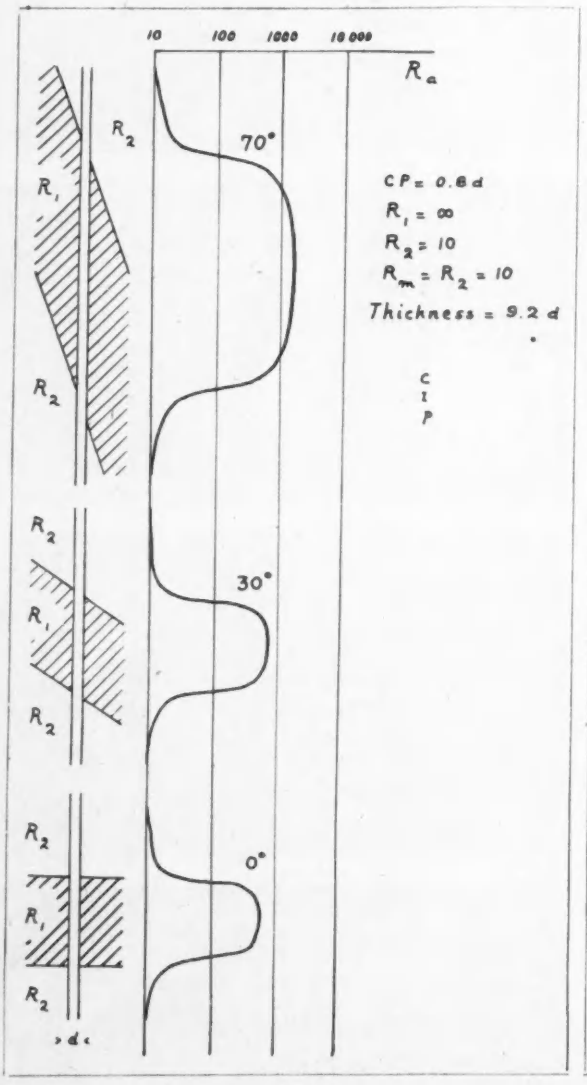


FIGURE 45. Two-electrode resistivity graphs made in same bed for various angles of dip. Scale model data. (From Dakhnov, 1941.)

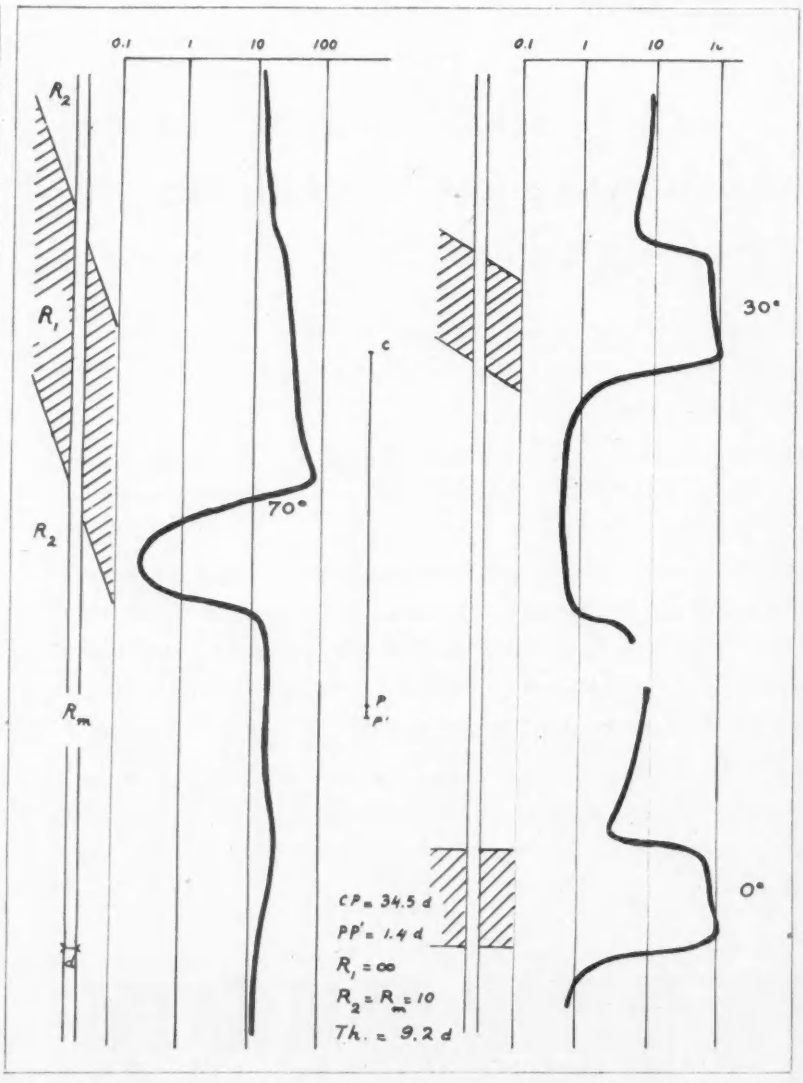
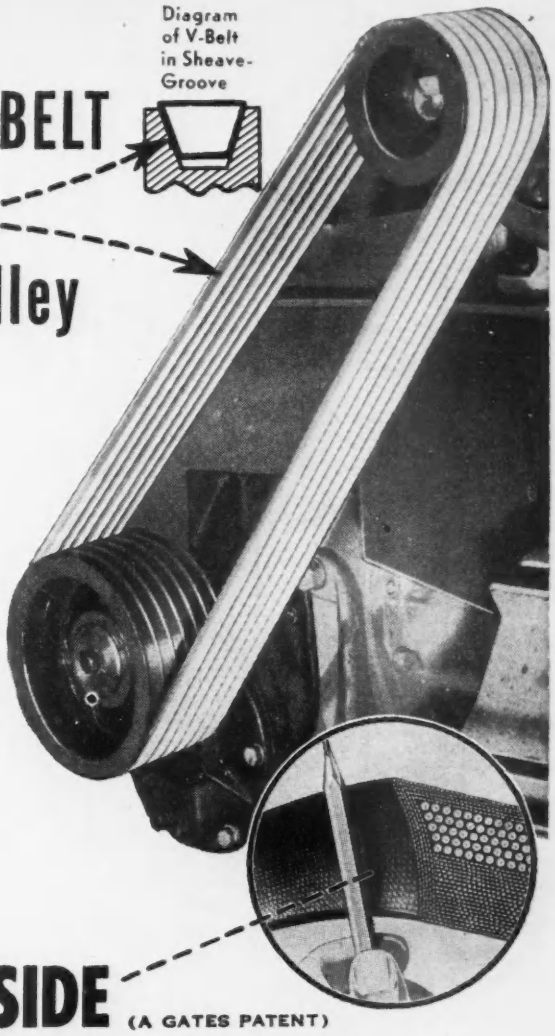


FIGURE 46. Three-electrode resistivity graphs made in same bed for various angles of dip. Scale model data. (From Dakhnov, 1941.)

The SIDE of a V-BELT is what GRIPS the pulley



Naturally, it GETS the WEAR!

Any one familiar with V-Belt drives knows that the sides of a V-Belt are what really get the wear.

It's the *sides* that grip the pulley. They *pick up* all the power from the driver pulley, *transmit* that power to the belt as a whole and then, once more, they *deliver* the power to the driven pulley. And, clearly, it's the *sides*—and *only* the sides—that take the wear against the sheave-groove wall.

That is why you have always noticed that the *sidewall* of the *ordinary* V-Belt is the part that *wears out first*—and, naturally, if you prolong the life of the sidewall, you *lengthen* the *life* of the *belt!*

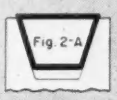
Now See How the CONCAVE SIDE (A GATES PATENT) SAVES Sidewall Wear and Lengthens Belt Life!

Straight Sided V-Belt

How Straight Sided V-Belt Bulges When Bending Around Its Pulley

You can actually feel the bulging of a straight-sided V-Belt by holding the sides between your finger and thumb and then bending the belt. Naturally, this bulging produces excessive wear along the middle of the sidewall as indicated by arrows.

Gates V-Belt with Patented Concave Sidewall



Showing How Concave Side of Gates V-Belt Straightens to Make Perfect Fit in Sheave Groove When Belt Is Bending Over Pulley

No Bulging against the sides of the sheave groove means that sidewall wear is evenly distributed over the full width of the sidewall—and that means much longer life for the belt!

The simple diagrams on the left show exactly why the ordinary, straight-sided V-Belt gets excessive wear along the *middle* of the sides. The diagrams show also why the Patented Concave Side greatly *lengthens the life* of the *sidewalls* of Gates Vulco Ropes. That is the simple reason why your Gates Vulco Ropes are giving you so much longer service than any straight-sided V-Belt can possibly give.

Saving SIDEWALL WEAR is more important NOW than ever before. ..

Now that Gates *SPECIALIZED* Research has resulted in Super Vulco Ropes capable of carrying much heavier loads—fully 40% higher horsepower ratings—the sidewall of the belt is called upon to do even more work in transmitting these heavier loads to the pulley. Naturally, with heavier loading on the sidewall, the life-prolonging Concave Side is more important now than ever before!

Gates

THE MARK OF SPECIALIZED RESEARCH

THE GATES RUBBER COMPANY Denver, U. S. A.

"The World's Largest Makers of V-Belts"

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GATES VULCO ROPE DRIVES

Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U. S. and 71 Foreign Countries

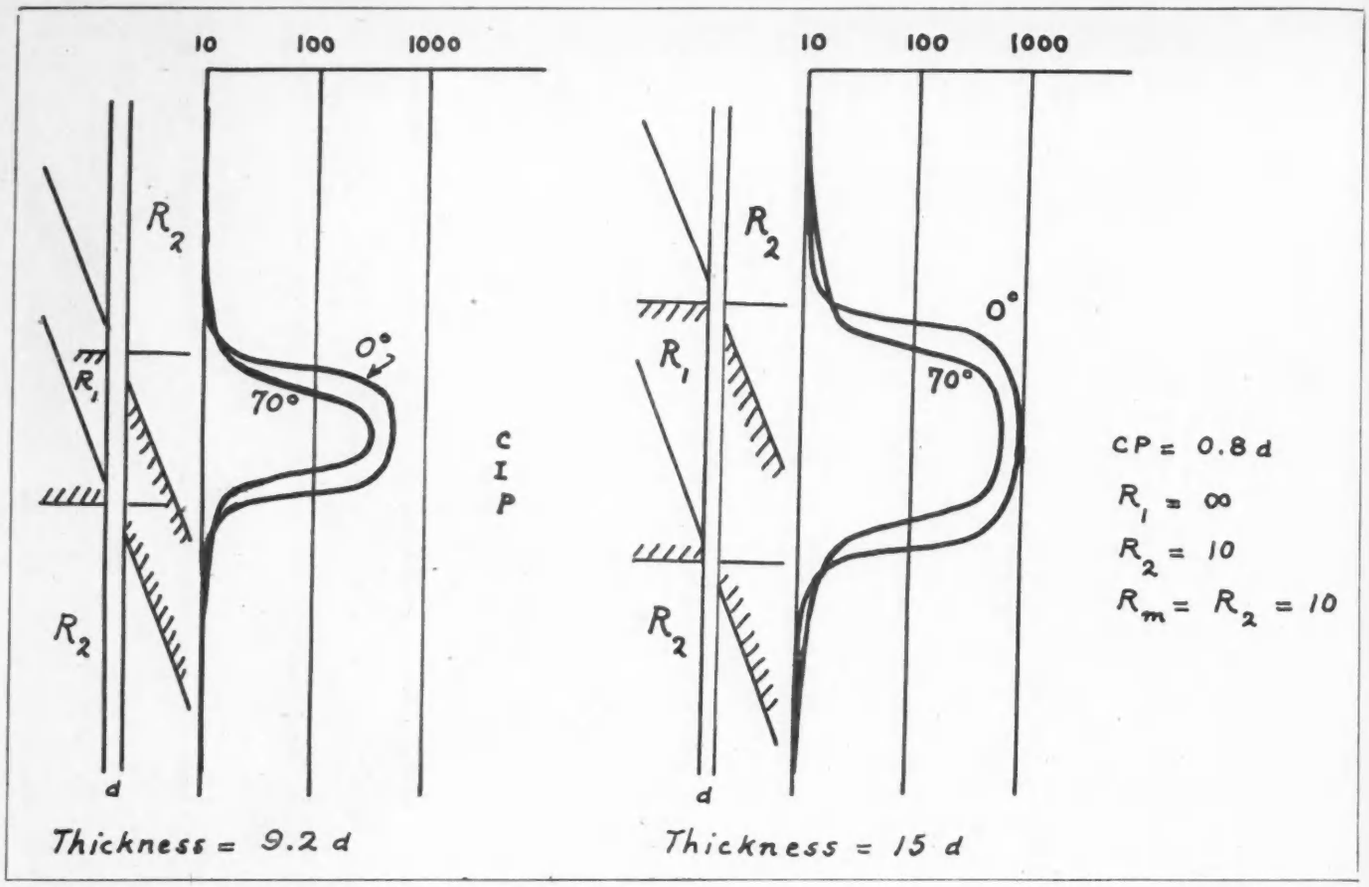


FIGURE 47. Two-electrode resistivity graphs made in horizontal bed and in tilted bed of same apparent thickness. Scale model data. (From Dakhnov, 1941.)

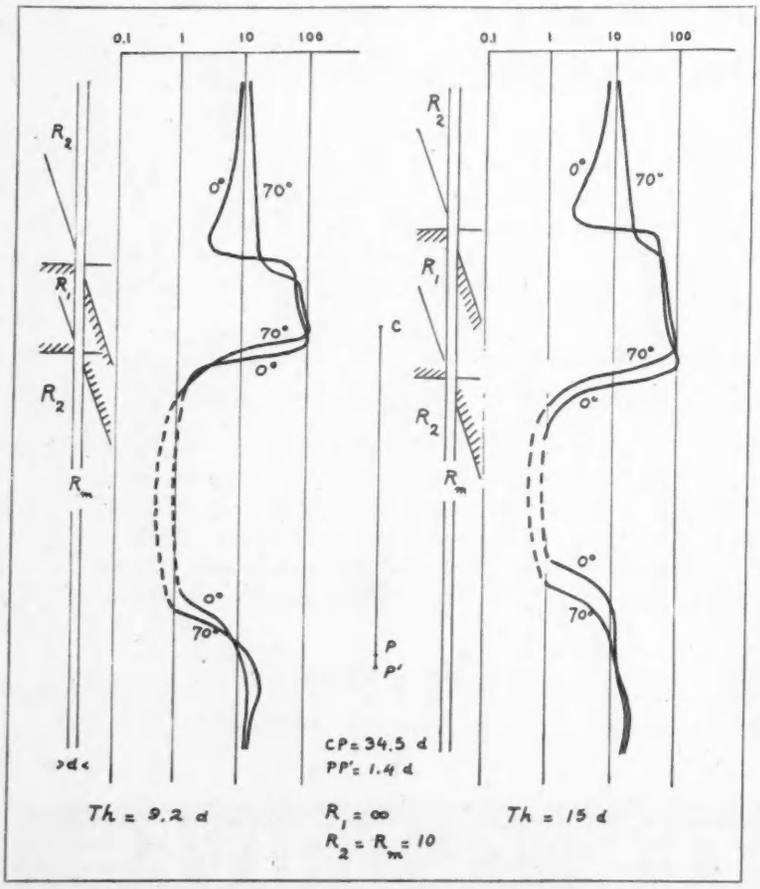


FIGURE 48. Three-electrode resistivity graphs made in horizontal bed and in tilted bed of same apparent thickness. Scale model data. (From Dakhnov, 1941.)

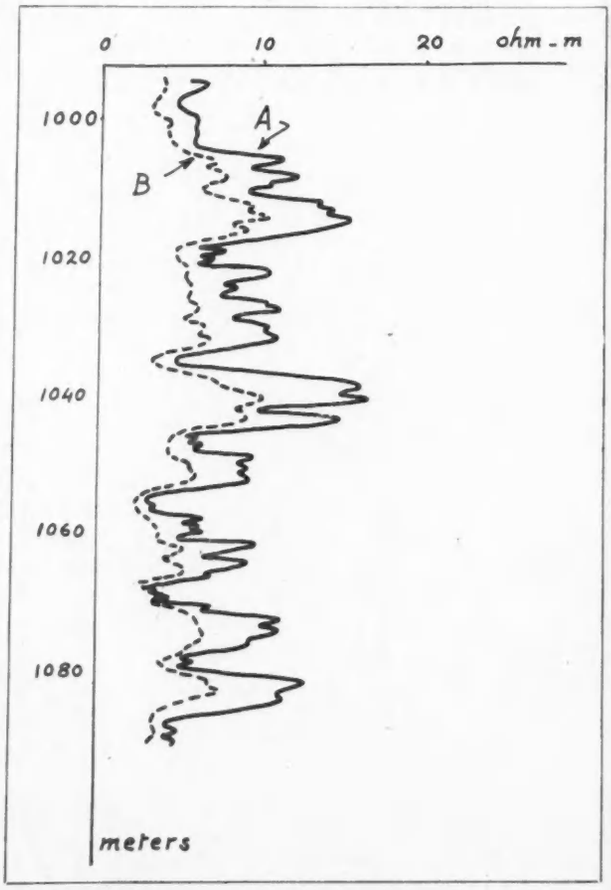


FIGURE 49. Resistivity graphs illustrating effect of electrode size. "A" was made with cylindrical electrodes of large diameter, and "B" with electrodes of smaller diameter. (From Dakhnov, 1941.)

WHAT TO LOOK FOR IN U. S. MATCHLESS PACKING

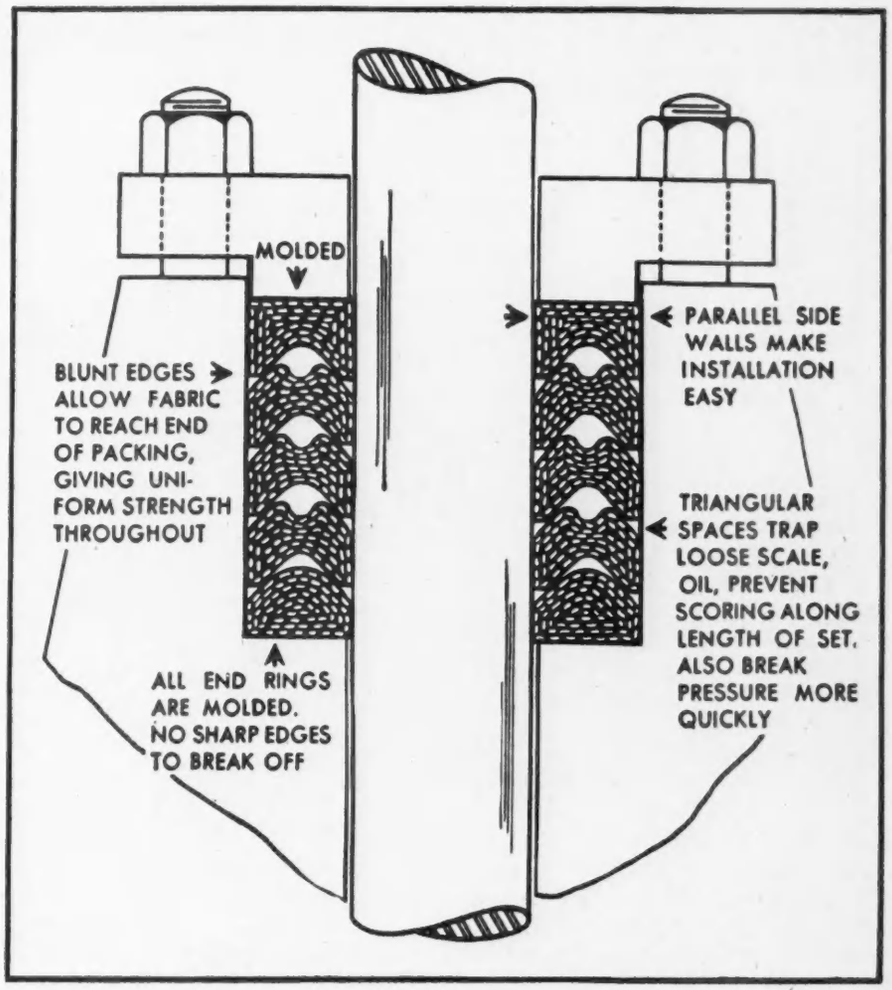
BLUNT EDGES—Give more efficient shape; allow fabric to reach end of packing, providing uniform strength throughout. In conventional packing (feather-edge design) fabric cannot be forced into sharp edge, leaving unprotected soft-rubber end to cause curling and chipping.

TRIANGULAR SPACES—Blunt edges provide triangular spaces for trapping loose scale, oil, etc. Result is lower coefficient of friction, less power required, and scaling does not score entire length of packing set.

PRESSURE BREAK—The triangular space of each ring breaks the pressure more quickly than ordinary types without this feature. With U. S. Rubber Matchless Packing design, automatic action is faster, more effective.

MOLDED END RINGS—Tests show the female ring and the one next to it take 70% of the pressure on the set. In Matchless, *all* rings are molded, are of proper density, and have no sharp edges to break off, as on end rings cut from slab.

EASY TO INSTALL—Matchless Packing has parallel side walls, while conventional packings are made with varying degrees of wall flare. Matchless rings slide easily into stuffing box; the flare type requires considerable effort and time.


MOLDED
BLUNT EDGES ALLOW FABRIC TO REACH END OF PACKING, GIVING UNIFORM STRENGTH THROUGHOUT
ALL END RINGS ARE MOLDED. NO SHARP EDGES TO BREAK OFF
PARALLEL SIDE WALLS MAKE INSTALLATION EASY
TRIANGULAR SPACES TRAP LOOSE SCALE, OIL, PREVENT SCORING ALONG LENGTH OF SET. ALSO BREAK PRESSURE MORE QUICKLY

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The self-adjusting, automatic action of Matchless results in reduced wear on rods and plungers, cuts down packing costs and time out for replacement. There is a precisely measured mold for every standard size, and many intermediate sizes can be made from existing equipment. For more information about Matchless, write Mechanical Goods Division, United States Rubber Company, 1230 Avenue of the Americas, New York 20, N. Y.

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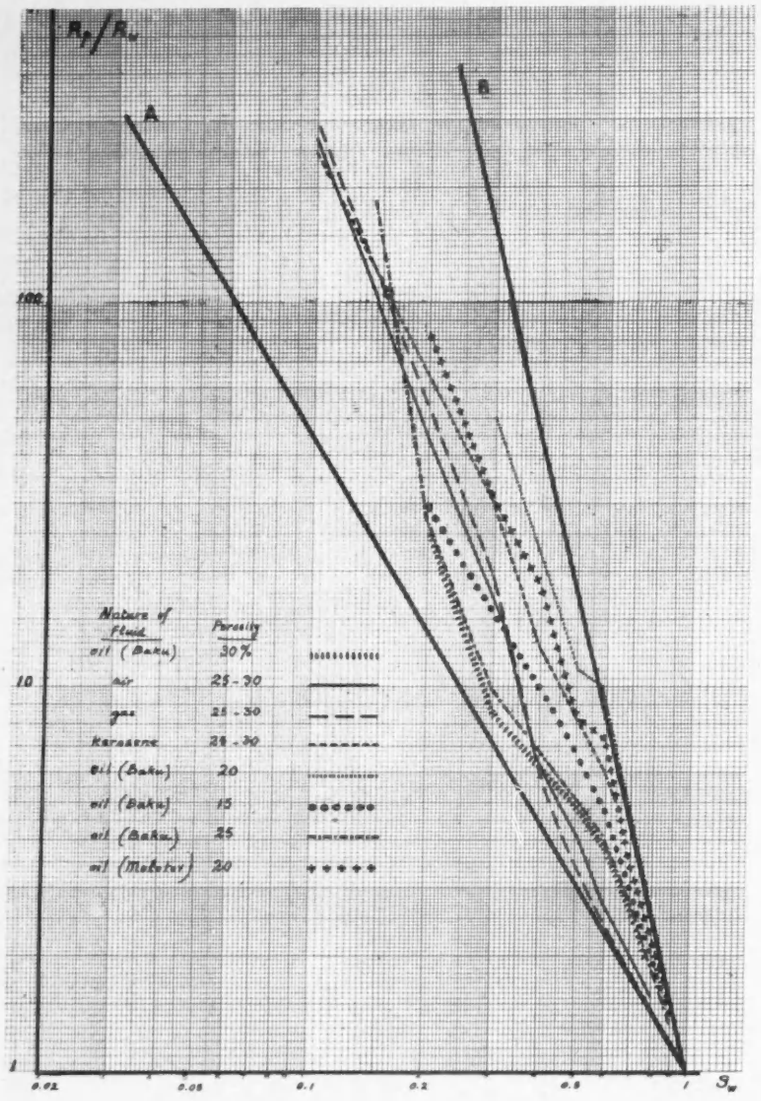


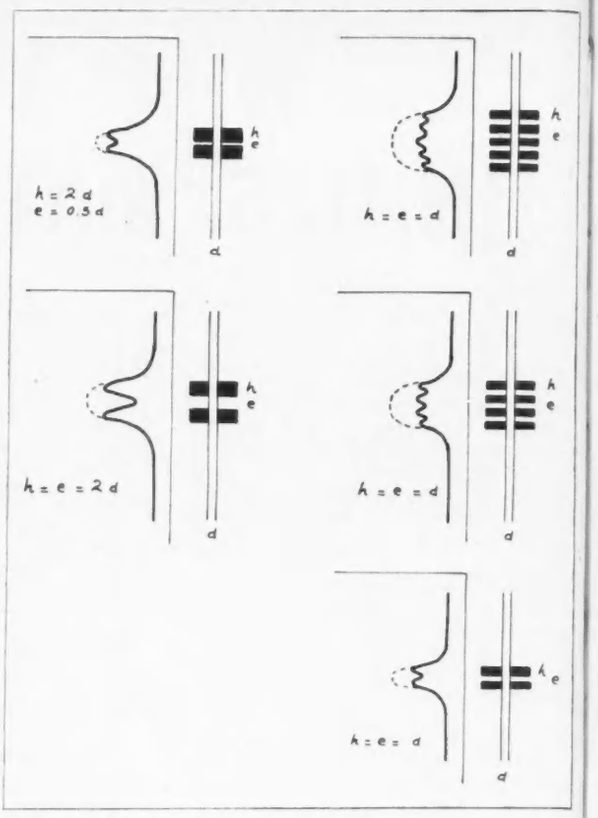


FIGURE 50 (Left). Laboratory resistivity-saturation curves for various sands. (From Dakhnov, 1941.)

FIGURE 51 (Right). Potential graphs in sandwich-type formations. (From Dakhnov, 1941.)

should be done primarily to secure preliminary information, such as thickness and approximate resistivity of the beds concerned. The most appropriate arrangements and spacings to be used for a subsequent run are determined from the preliminary electric log.

Inasmuch as satisfactory interpretative data are not available as yet, there is no necessity to elaborate further on this point at the present time, except perhaps to mention that today's conventional electric logs usually do not comprise enough resistivity graphs to permit estimating the characteristics of petroleum reservoirs.

Effect of Bed Thickness

To give the reader some idea of the influence of a few of the factors which have to be considered in electrical logging, several figures taken from Dakhnov's book are reproduced below.

Figures 41 and 42 illustrate the effects of a conductive bed situated in the center of a very resistant formation.

Figures 43 and 44 are experimental resistivity graphs obtained on an alternation of thin resistant and conductive beds. The data were secured by Dakhnov to help in the interpretation of the electric logs made in the Maikop field.

Figures 41 through 44 show strikingly the complexity of the problem of interpretation in broken reservoirs.

Influence of Formation Dip

Figures 45 and 46 are experimental resistivity graphs obtained on the same resistant bed for several values of the angle of dip. Figures 47 and 48 give data for a horizontal bed and for a tilted bed having the same apparent thickness.

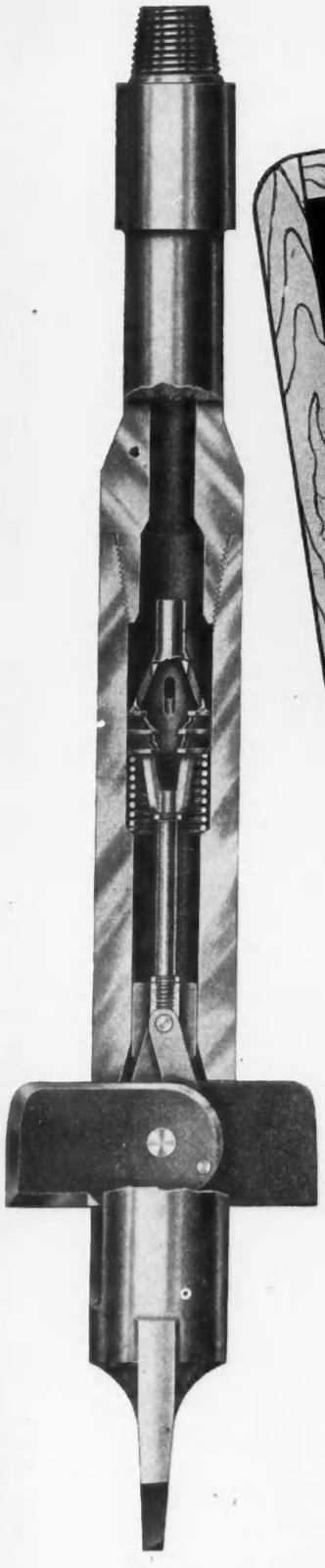
Figure 49 represents two resistivity graphs taken in a Russian well. The broken line graph was obtained with small cylindrical electrodes (diameter: about 1½ inches), while the solid line graph was obtained with electrodes having a much greater diameter (size not given, but presumably close to bit size). The larger electrodes give apparent resistivity values which are about twice as great as those obtained with the small electrodes. This illustrates the necessity of correcting the field data for electrode dimensions when using the conventional departure charts calculated for extremely small electrodes.

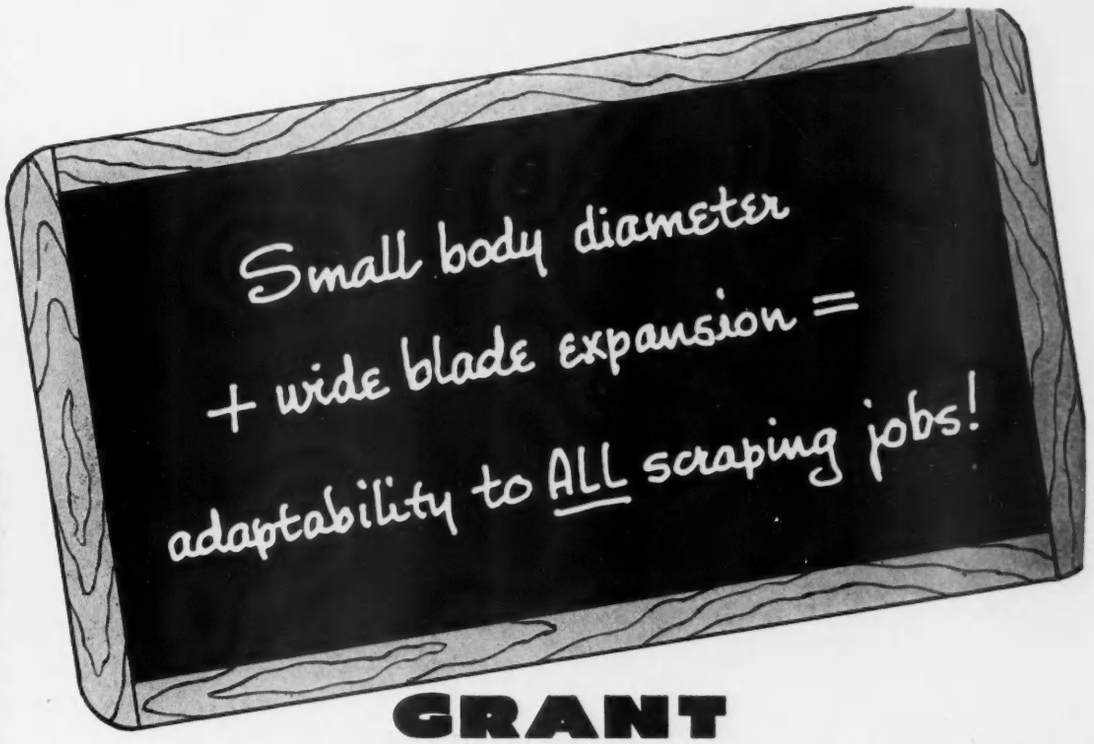
Figure 50 summarizes laboratory experiments made in the U.S.S.R. on the relation between interstitial water saturation and reservoir resistivity. Water saturation fraction S_w is plotted as abscissa and ratio R_p/R_w is plotted as ordinate. R_p denotes resistivity of sample, and R_w resistivity of same sample when entirely saturated with water. Lines A and B represent the limits of the experimental curves. For the samples investigated the following relation obtains:

$$S_w = (R_w/R_p)^{1/n}$$

the numerical value of n being comprised between 1.7 and 4.3. The data are in reasonable agreement with those obtained in this country.

While considerable information on resistivity can be found in Dakhnov's book, there is but little data of importance on bore hole potentials. Perhaps the only interesting contribution is a discussion of the potential graph when the formation concerned comprises an alteration of very thin beds. Typical graphs for this sandwich-type formation are shown in solid line on Figure 51. The broken line represents the potential graph which would be obtained if the formation were uniform.





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Available in seven sizes, the Grant Hydraulic Expansion Wall Scraper provides scraping ranges from 4¼" to 36", and can be had in the bull nose type as well as the diamond-point pilot bit type illustrated at left. Send for Descriptive Bulletin No. 20, or contact your Grant representative for full details!

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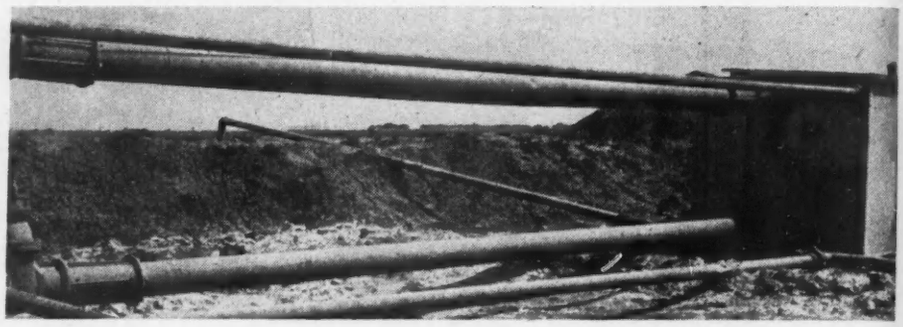
HOW TO—Provide Dual Flow Discharge Connections on Mud Tanks

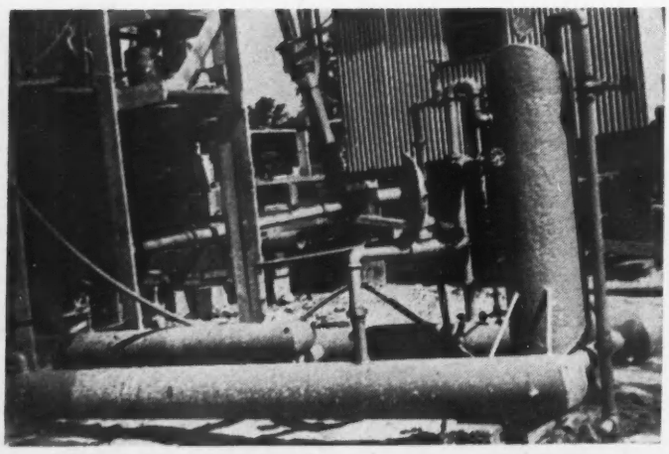


Added flexibility may be obtained from the mud system where more than one tank is used by providing two discharging connections rather than one. In the case illustrated, the tank bottoms were connected by an eight-inch line to permit equalization of fluid level in both tanks where this is desired. In addition, a similar line connects the two tanks near their upper edge. This line is called the overflow mud line and is not equipped with a valve. In wells where considerable sand is encountered and it is necessary to drop out as much of this sand as possible, one mud tank can be used as a settling pit while the second tank, shown at far right, serves as the sump pit. In this case, the equalizing line, or bottom line is shut off by the valve shown at extreme left. With the bottom line shut off, the mud must flow through the overflow or top line. By this method, the fluid is taken from the top of the settling pit and a maximum of sand is permitted to settle out.

On the other hand, if a considerable volume of mud is desired in the circulatory system, in cases where cavities are expected, or where lost circulation is a hazard, both tanks may be connected through the bottom or equalizing line. The valve would remain open and mud would flow through this line as long as the mud level remained below the upper line.

To facilitate installation and tear down of the mud system, sleeve-type couplings have been installed. Considerable time is saved in this installation since the mud lines can be coupled in minimum time.

HOW TO—Clean and Store Cheap Field Gas for Use as Engine Fuel



Where drilling rigs are equipped with gas-gasoline engines, and these rigs are operating in an area where cheap field gas is available, it is likely that the gas will be used as a source of fuel. However, in using this field gas, the rig operator must take precautions to insure a clean gas free from moisture and foreign particles.

A self-contained, dual-purpose device was designed to scrub the field gas as well as provide a volume tank. The scrubber element consisted simply of a 40-inch section of 12-inch casing which had been sealed at both ends. Gas entered the scrubber at the top through a two-inch line. A coupling was welded to the top of the scrubber on the opposite side where a discharge line was connected.

The volume tank was made into the form of a skid from two 14-foot pieces of eight-inch line pipe. The ends were sealed and the two sections joined at three points: on each end and at the middle. The cross members were of three-inch pipe and connected the two chambers together. Gas was discharged from the scrubber, the pressure reduced by a spring-loaded regulator, and then passed into the volume tank. At the extreme left end of the unit may be seen the two-inch line and valve which control the flow of gas to the various engines.

The scrubber is mounted by means of four steel rod braces which support the chamber in a vertical position as shown. The volume tanks are sturdy enough to form a skid-like structure which facilitates its transportation from one site to another. The entire unit was fabricated from scrap materials and has been a useful piece of equipment in insuring a clean fuel for the prime movers.

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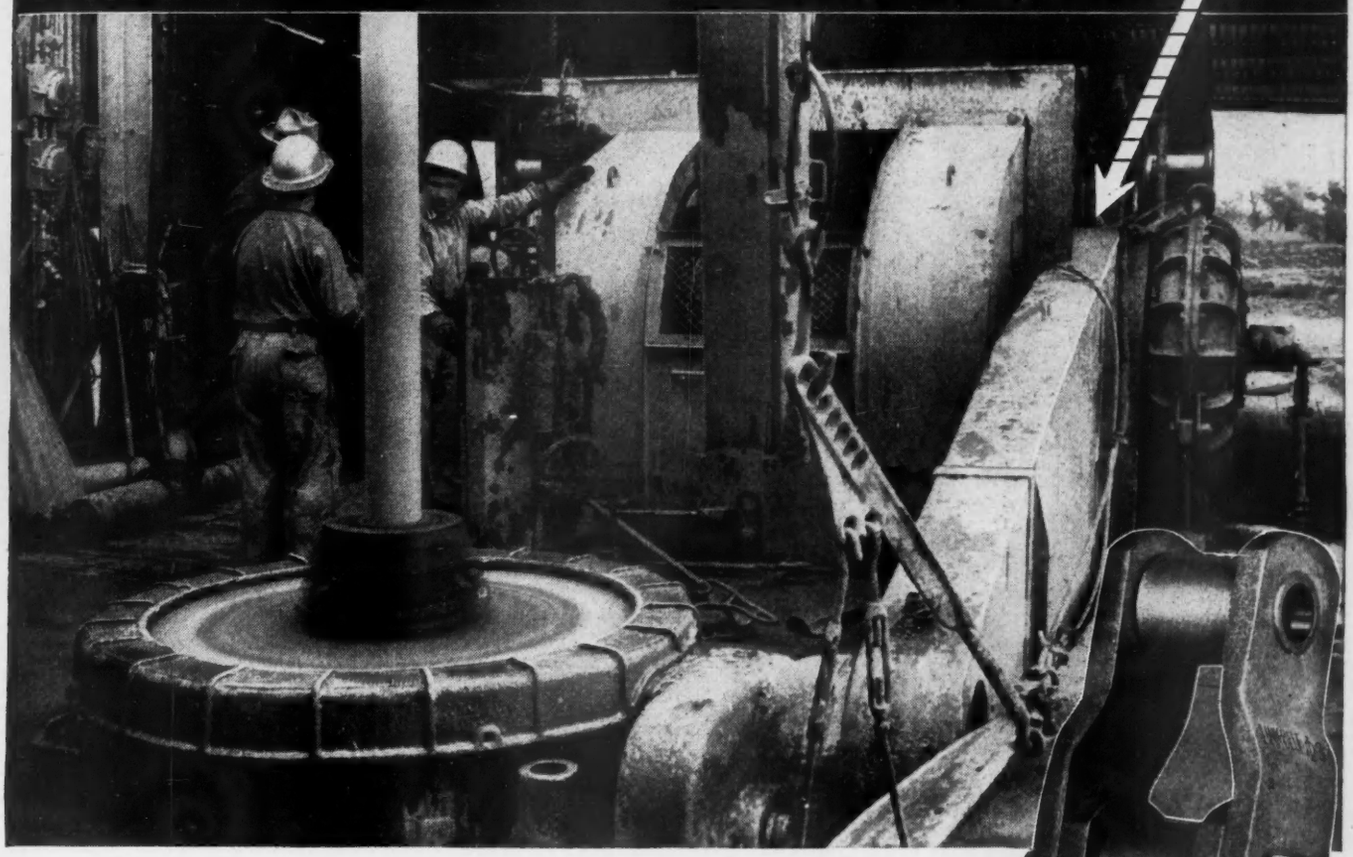

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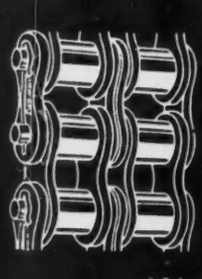

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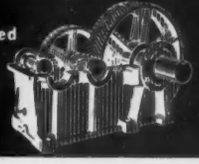

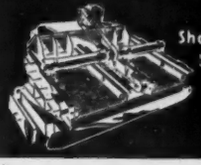

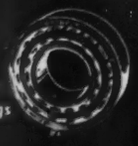

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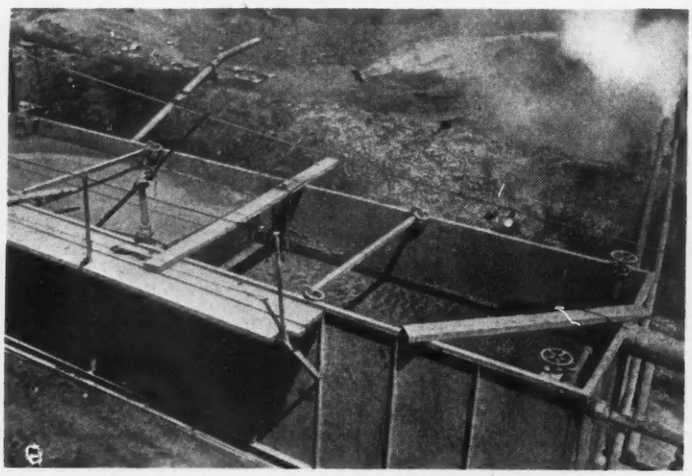
HOW TO—Increase Utility of Steel Mud Tanks



The addition of several useful items to steel mud tanks will increase their utility and efficiency. To a standard mud tank, such as that illustrated, were added mud jetting guns, a weir partition and lifting eyes, thereby making it actually serve the purpose of two tanks, and at the same time providing a higher quality mud.

To the midpoint of the tank, a solid steel partition was welded across the narrow width, extending from tank bottom up to a height about eight inches below the upper edge of the tank. This partition serves as a weir over which the mud must flow before passing into the mud pump sump at the right half of the tank shown. Mud enters the tank at the left where fine particles of sand are permitted to settle out. As the mud passes over the edge of the partition, entrained gases are given a better chance to escape, thereby improving the condition of the mud. Mud pump suction is taken from the right half of the tank near the bottom.

Four mud jets have been incorporated into this particular tank, one in each corner and controlled by a valve handle at the corner. Two-inch pipe supported to the inside of the tank serve this purpose. They are connected to the auxiliary or mixing pump. In the case where the rig is being moved, these jets are used to clean all mud and sand from the tank by jetting clear water into the tank bottom. In the mud pump sump tank, the jets serve to maintain a uniform quality mud by continually stirring the mud during circulation.

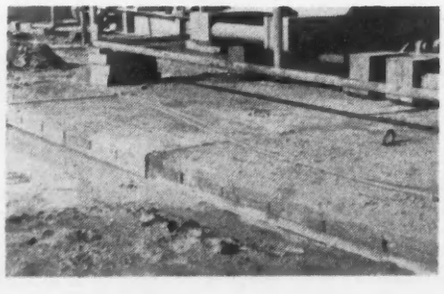
Another useful feature of this tank is the four lifting rings which facilitate loading and unloading the tank from trucks where lifting facilities are available. The tank is also mounted on skids so it may be dragged onto trucks and into position.

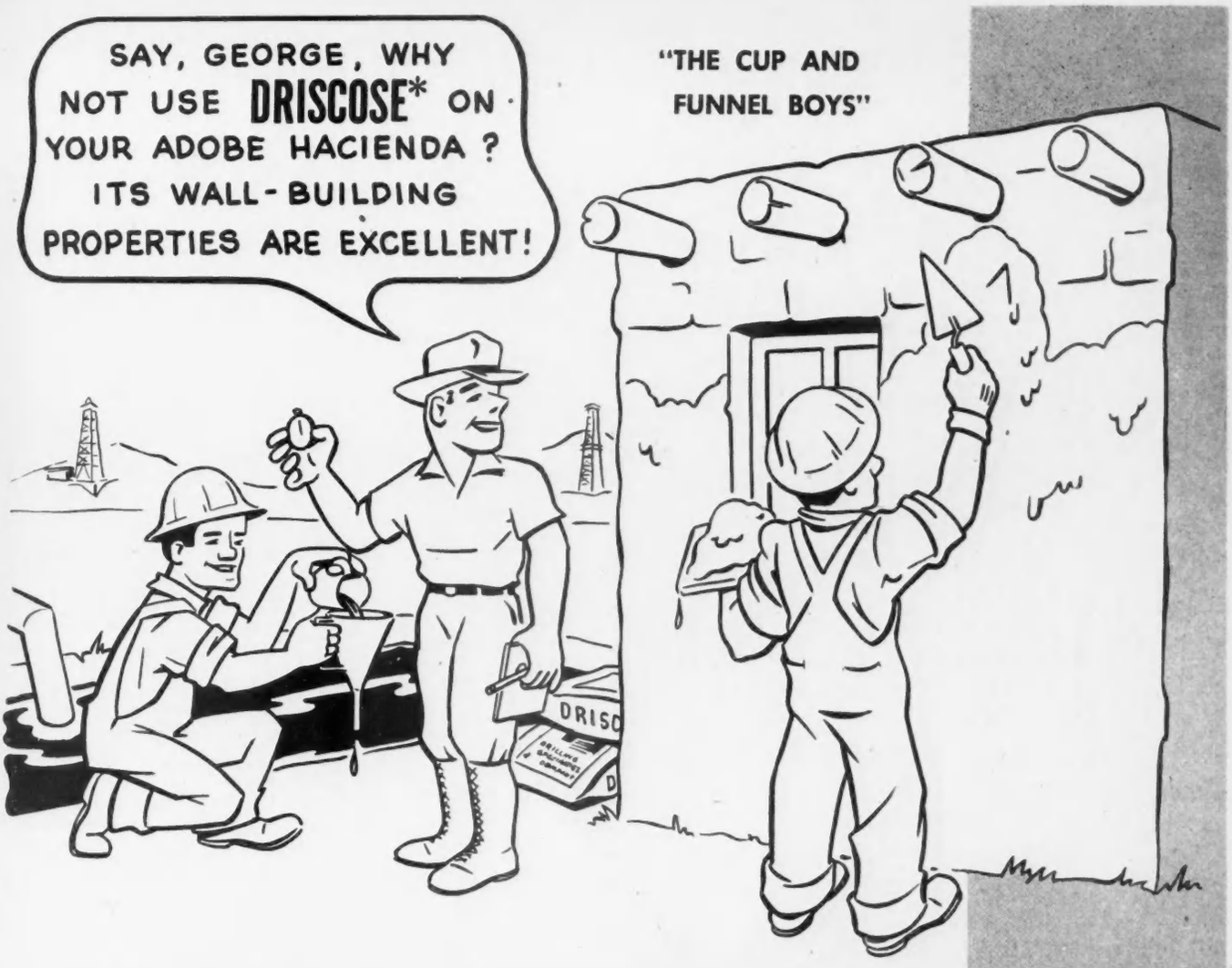
HOW TO—Sectionalize Foundation Mats on Rigs

In any area where foundations are required for auxiliary equipment of a drilling rig, sectional mats have proven to be economical in both material and time of rigging up and tearing down. Mats for supporting mud pumps and engines are made in several sizes, 6 x 8 feet, 6 x 6 feet, and 8 x 8 feet, to fit into various situations.

The method of construction is similar to that of ply-wood, in that three layers of unfinished 2 x 12-inch planking are used, securely spiked together to form a rugged section. Eye bolts with rings are set into each section for lifting with a sling or bridle on a rigging crane or truck boom after the surface of the ground has been graded, when rigging up, for placing in position as a foundation of the equipment.

The rings drop into recesses chiseled out of the planking to remove a hazard for men working in the area. These mats are a substitute for concrete floors, and are used where the ground is to be graded after the well is completed, so appearances can be restored.

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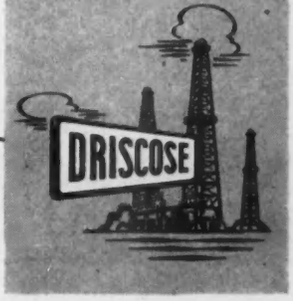

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In order to assure clean, abrasive-free oil being circulated to the several lubricating points on the drawworks and mud pump power equipment, one operator in the Rangely Field of Colorado employs a five-foot long combination settling tank and reservoir tank made of salvaged ten-inch casing. Mounted on two short legs, the double compartment reservoir has a hinged cover, the latter made by cutting out a section of the pipe, and welding on hinges and a convenient handle.

The lubricating device is set up on the floor beside the equipment and held in position by driving spikes through holes burned through the angle iron bases. Returning lubricating oil enters the reservoir and travels the full length before arriving back at the pump pick-up point where clean oil is taken from near the top of the settled fluid. The small pump is one salvaged from an automobile engine, and it was found to have just the correct capacity for this type of service.

It is driven by a single V-belt take-off from a convenient shaft, the end of which is brought out through the metal guard as shown. Any desired speed and consequent rate of circulation is possible merely by using sheaves of the proper diameter. A ⅜-inch pipe nipple at the lower, or settling end, of the reservoir is opened periodically to drain off accumulated water and sludge.

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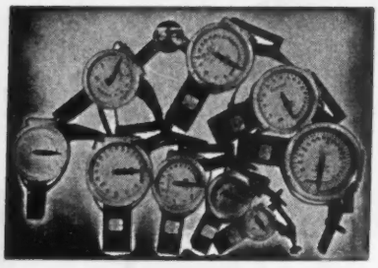

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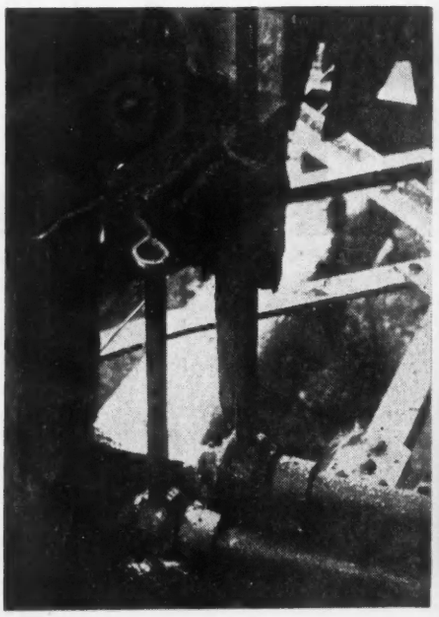
HOW TO—Lock Cable Tool Controls in Position

The two clutch levers on a standard end cable tool rig, one for the band wheel and the other for the sand line reel, too often are allowed to fall where they will when the driller finishes with a certain operation, or at best, they are tied back in a haphazard fashion with a cord or piece of wire. To overcome this problem, a small shelf was mounted between the two levers and a steel pin arrangement was made which provides a positive hold-back for the two levers.

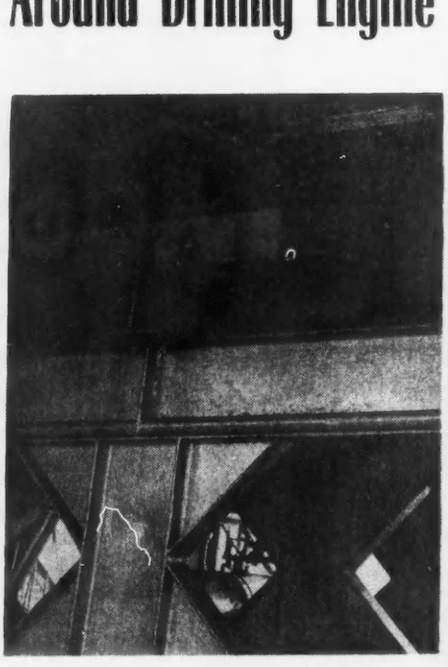


On each side of the shelf was welded a short length of ½-inch pipe laid parallel to the direction of travel of the levers. A steel pin provided with a finger loop at one end was run through each of the pipes and the ends then turned through a 90-degree angle, as shown. These turned-out fingers face outward and in opposite directions, and extend out far enough to hold the clutch levers in their normally vertical positions. Disengaging the pin consists of merely flipping up the pin with a finger.

Not only does this speed up the work of the driller by not requiring his attention in fastening back the levers each time, but it provides an important safety factor as well. When a lever is once locked behind one of the latch fingers it cannot be accidently released due to vibration of the machinery.

HOW TO—Elevate Floor Around Drilling Engine

Lubrication, inspection, and repairs to the large steam drilling engine on heavy-duty rigs can be facilitated with considerable convenience by elevating the floor surrounding the engine. Connecting up the piping to the engine as well as dismantling it was eased somewhat since these connecting points were at working height. Lubricating the engine was made easier by raising the flooring without sacrificing any operational advantage.



After the drilling engine substructure had been set in position and the engine bolted to cross I-beam members, longitudinal I-beams were laid parallel to the engine substructure on top of the cross members as shown. Perpendicular to these beams were laid other beams of smaller size which supported the wooden flooring. By adding these beams, the flooring was raised approximately one foot to bring about these conveniences.

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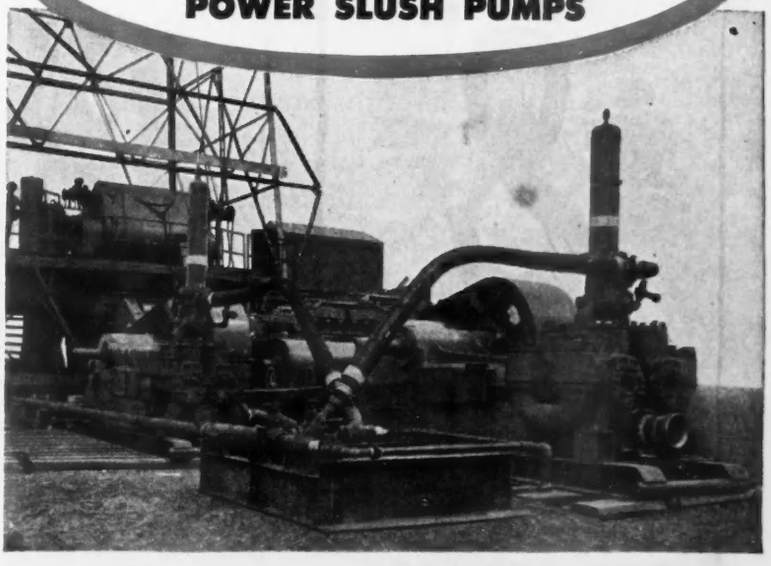

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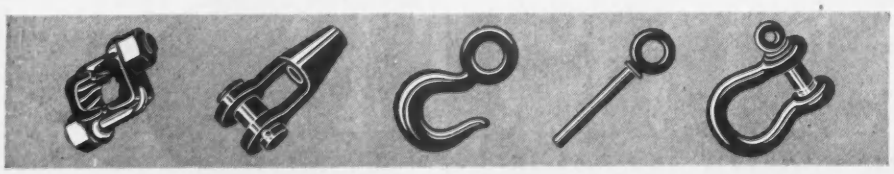


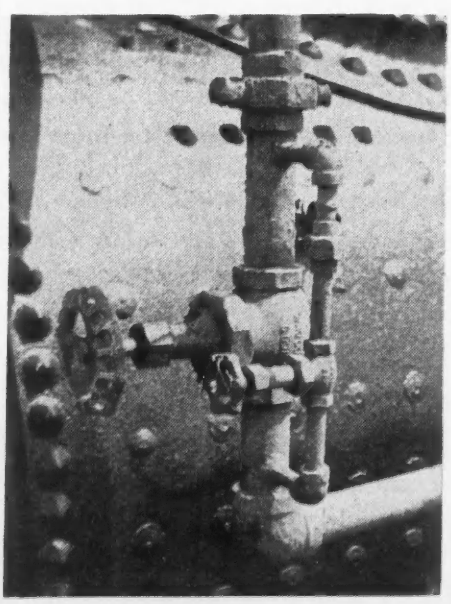
HOW TO—

Arrange Set of Valves To Control Steam Flow

Where the flow of steam or gas must be closely controlled through a wide range, a set of valves may be arranged as shown. Using a two-inch globe valve in the main line, a half-inch needle valve is set beside it by welding in nipples on either side of the main valve. A union is provided in the bypass line so that the valve may be changed in case it does not function properly.

In operation, the main line valve is kept closed and a minute adjustment maintained on the bypass valve until a flow larger than that which will pass through the needle valve is required. Then the large globe valve is cracked sufficiently to allow approximately half the capacity of the needle valve to pass. Then the needle valve is adjusted to regulate the flow required. This provides a close control of feed water pumps, heaters, etc.

In case the two-inch valve has been closed for an extended period against high steam pressure, the bypass valve can be used effectively to facilitate opening the larger valve. The smaller needle valve permits the pressure to bypass and equalize on both sides of the two-inch valve, thereby equalizing the force on the valve seats. Added life of the valve results from such practice when opening the larger valve against high pressures when downstream pressure is nearly atmospheric.



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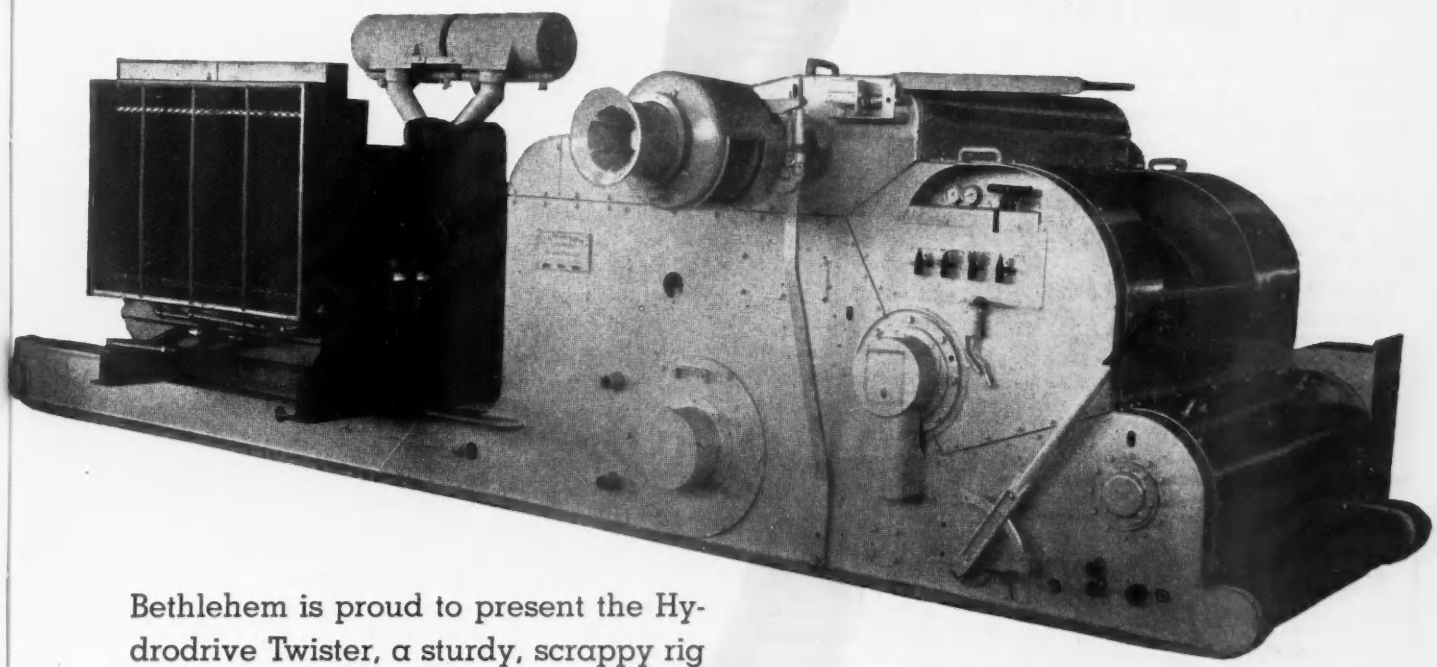

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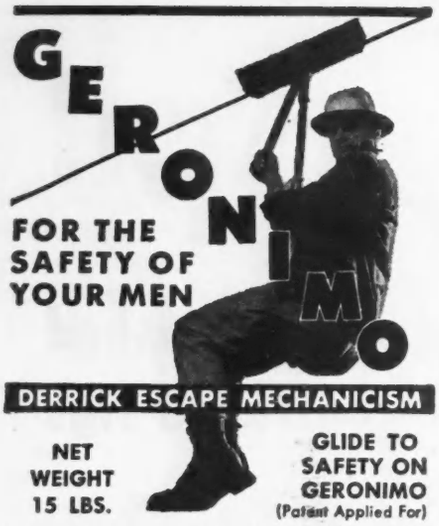

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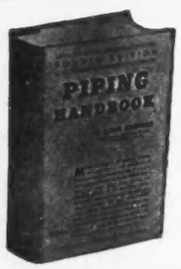
Senior Engineer, Engineering Division, The Detroit Edison Company



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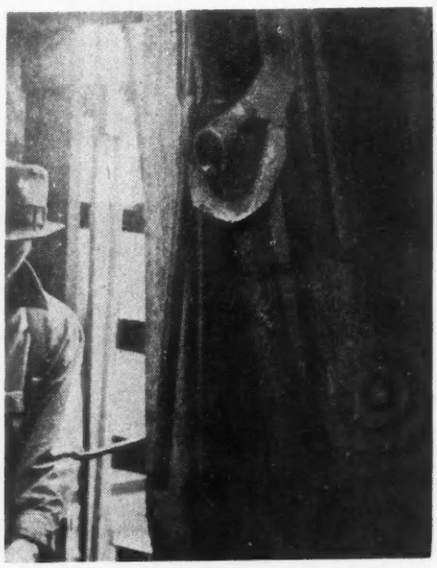
HOW TO—Fill Up Open Hole on Cable Tool Rig

Instead of using a water hose or bucket to pour water into the bailer or open hole after each screw, the driller on one cable tool rig merely lowers a length of two-inch pipe which swings in a vertical plane. The line is pivoted through an elbow anchored at the edge of the derrick floor and is tied into the water supply. The pipe is turned upward at the base of the headache post and is held in position against it by a simple device made from a piece of old belting, the latter holding the spout at a point near the outlet fitting.

A leaf-shaped section of belting with a hole cut in it large enough to admit a two-inch elbow is nailed by its narrow end to the headache post at the proper height. This height is governed by the length of the pouring spigot which in turn is determined by the distance between the swing at the base of the headache post and the center of the hole in the middle of the derrick floor. The spigot end of the upright pipe is fitted with an elbow to more easily guide the water into the well when the pipe is brought down to its horizontal position.

After the spout has been used, it is but a moment's work to bring it up behind the piece of belting and allow it to hang in the holder until needed again on the next screw. The water supply may be taken from a small water tank

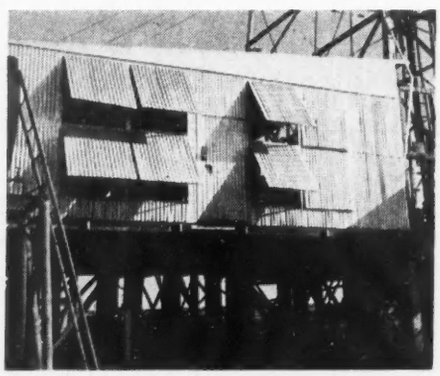


on or near the derrick floor at spigot level (in which case no valve is necessary), or a plug valve may be installed in the movable piece of pipe if water is under a higher pressure.

HOW TO—Sectionalize Rig Siding for Ventilation

Selective ventilation is possible in the enclosed drawworks house designed by one operator in the West Texas area. Each side of the house, equipped with a galvanized corrugated iron covering, is provided with eight square openings, the reinforced covers of which are hinged at the top and are opened from within and held at any desired angle by operation of a notched bar.

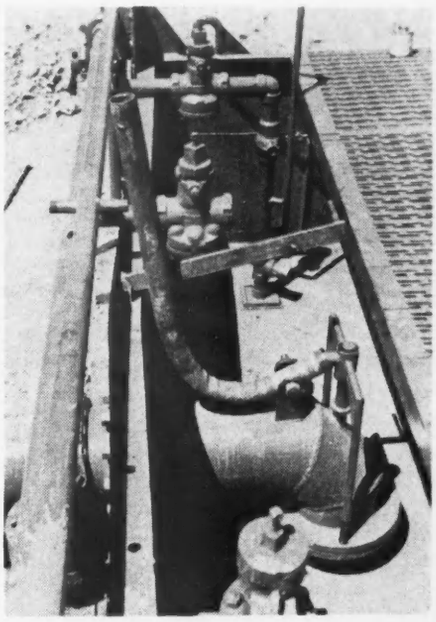
In the winter time it is particularly desirable to have ventilation, especially opposite the engines, without having to expose the entire house to the cold. Opening of only one or two apertures might be necessary nearer the driller's position. An added advantage of this type aperture is the fact that when full opened, the extended awning-like covers provide a degree of protection from wind-blown snow, ran, or dust. In the



summer time, cross ventilation is possible with apertures opened to regulate flow of air to and away from the engines as well as to take advantage of prevailing breezes coming from either side of the rig.

HOW TO—Build Simplified Mud Intake Valve

Simplicity of action is the outstanding feature of a shut-off valve that is easily installed on the mud intake line inside the mud tank. A steel disc attached to a pair of vertical lift rods, the latter actuated by a pivoted L-shaped handle extending above the edge of the tank, is mounted so that it may be drawn up against a matching flange welded to the end of the intake pipe, the assembly being visible in the illustration. The two vertical bars of the lifting rack pass through holes drilled into the upper flange, assuring positive alignment of the two valve faces.

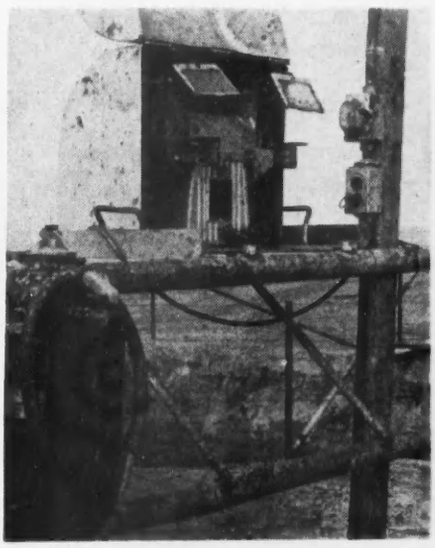


To stabilize and guide the vertical motion of the valve plate lifting rack, a solid bar of one-inch round steel was welded to the surface of the sloping intake pipe. A short length of pipe, having a slightly larger inside diameter, and which slips over this guide post, is included in the horizontal member of the lifting rack. A short stub of round steel bar, welded to the pipe sleeve and at right angles to it, is engaged by the lower end of the curved pipe handle with which the valve is operated.

To hold the valve in either the open or closed position, a latching device is provided. A short bar welded to the side of the pipe handle engages either of two notches cut in the under side of a flat bar hinged to the edge of the tank. All fittings are made with sufficient tolerance that the device will operate satisfactorily with little possibility of sticking in the presence of heavy mud or grit particles.

HOW TO—Mount Tool Grinder on Pipe Rack

So that men on the drilling rig may sharpen tools at the pipe rack near the derrick, one drilling company devised a mount for the tool grinder which is attached to the top hand rail of the guard at the side of the pipe rack. The tool grinder, electric-driven, is set on a flat sheet of steel carrying both the grinder and the weatherproof cover for the motor. The floor for the grinder rests on a support made of sucker rods which are tacked to the hand rail for support. Braces are tacked to the opposite ends of the support rods and slope diagonally to the bottom rail of the guard where they are also welded. A two-by-four is clamped to the rails near the grinder for mounting plug-in fixtures and starting switches.



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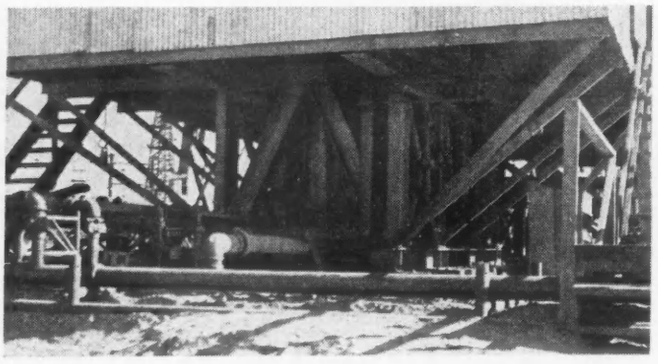
HOW TO—Erect Rig Floors Around Drilling Engine and Substructure



Whatever the operator of a large or small drilling rig can do to decrease the time required to tear down or erect his rig will be a worthwhile venture in modern drilling. The trend in new drilling rigs is toward simplification, standardization, and increased portability. Every operator has his own ideas about speeding up the job of tearing down or rigging up his equipment. Illustrated is one way to cut the time required in erecting the rig floor around the drilling engine and substructure.

Since the primary function of the walkways around the drilling engine is to accommodate the crew who must service and repair the engine, it need not be as substantial as other substructures. Close observation of the substructure shown will reveal that the design of the supporting members of the flooring are easily removed for dismantling the rig.

Extensions of the flooring around the drilling engine are hinged to the engine substructure. There are four of these I-beam extension members on either side of the rig. The outer ends of each extension are supported by a channel iron brace which is bolted to the lower support of the engine substructure as shown. Two heavy bolts at each joint provide adequate strength for these members to support men and auxiliary equipment on the floor above. Floor joists of 2x12-inch lumber are laid on edge and cross wise to the horizontal I-beams. A heavy wooden floor is nailed to these joists.

After the engine substructure has been set in place and the engine put in position, it is a relatively simple matter to add the flooring supports. A minimum of pieces are required and, too, when the unit is erected, less obstruction exists to movement around the rig structure.

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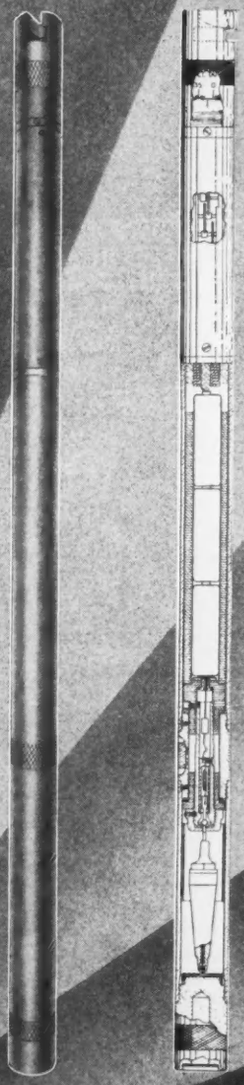

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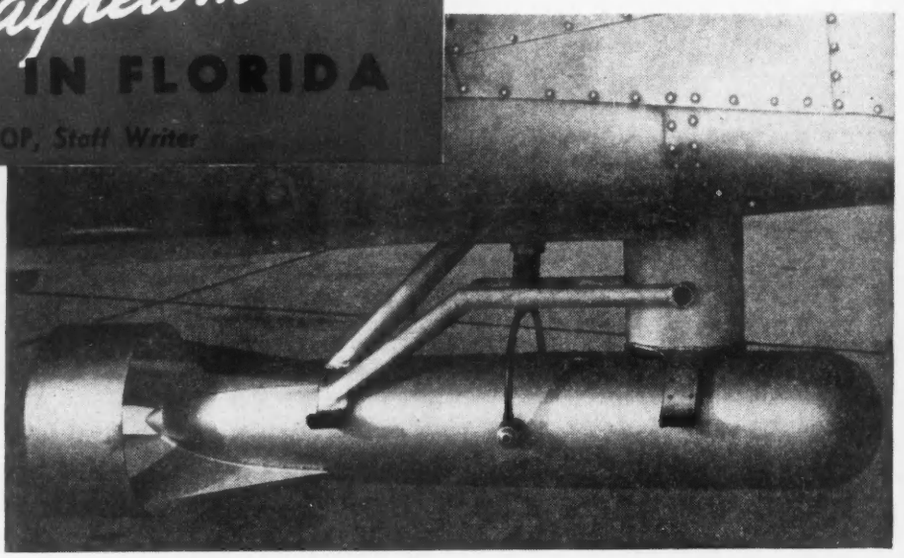
GULF'S *Airborne Magnetometer* IN FLORIDA

By J. E. KASTROP, Staff Writer



How the "bird" rides in the ejecting mechanism held in position beneath the airplane. The ejecting mechanism extends far enough beneath the fuselage so the magnetometer is completely within the slip stream. Once the magnetometer is within the slip stream, its bomb-like shape permits it to be aerodynamically stabilized in a horizontal position.

PROSPECTING FOR OIL in Florida has been both expensive and disappointing to many oil companies. Because seismic methods have not yielded satisfactory results in showing the way, Gulf Oil Corporation brought its airborne magnetometer to Florida. This new prospecting tool has aroused hope for a better geological picture of subsurface Florida.

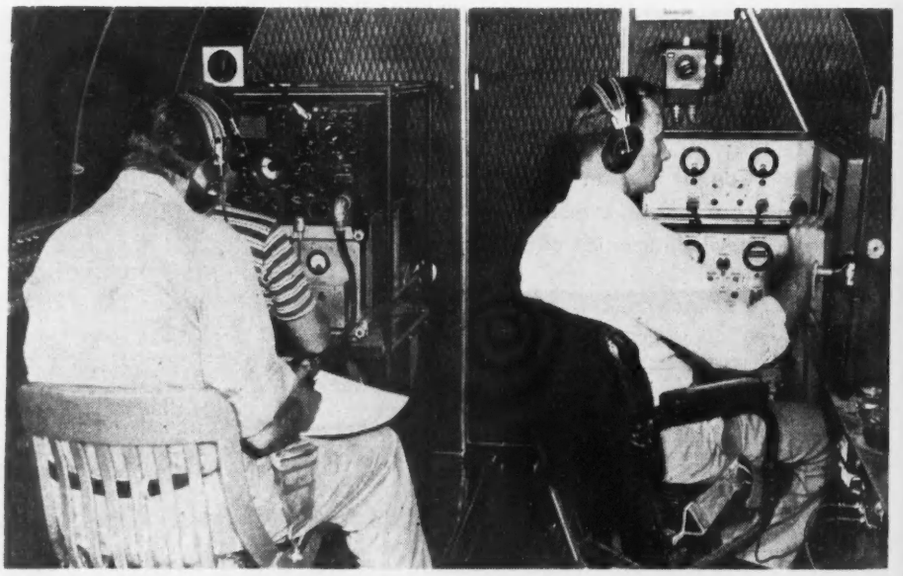
LATEST developments in instruments and operational techniques devised by Gulf Research & Development Company are being employed in Gulf Oil Corporation's airborne magnetometer survey of Florida and adjacent coastal waters. Before the project is completed, it is expected that approximately 40,000 square miles will be surveyed, including about 4½ million acres under lease by Gulf.

The survey is being conducted by Gulf's Airborne Magnetometer Crew No. 15, which recently completed a magnetometer survey in West Texas. The group arrived at the Sarasota-Bradenton airfield, 50 miles south of Tampa, on April 19, 1948, where headquarters were established. After a week of test flights and other preliminaries, the survey was begun.

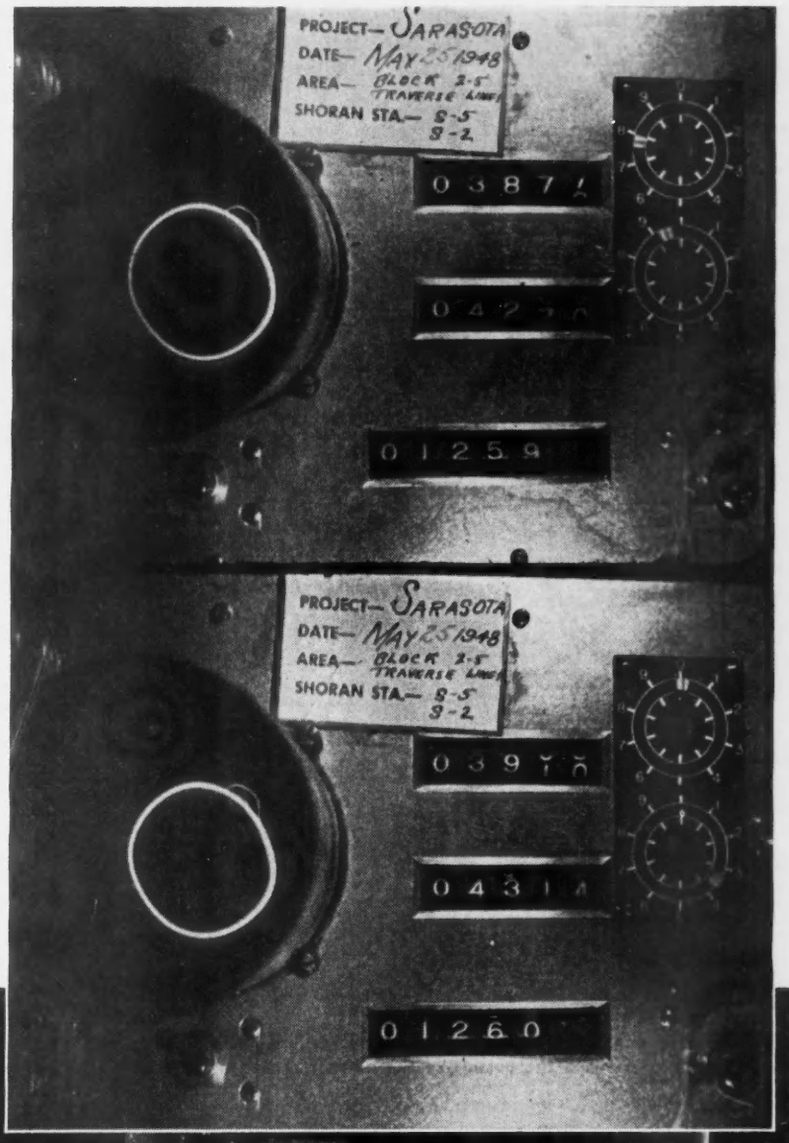
As of the week ending May 28, 1948, the crew had surveyed approximately 6000 square miles covering the Florida Keys and the southern tip of Florida. In an average week, the crew will survey about 2200 square miles, and given good weather and few equipment breakdowns, the group can cover 3000 square miles in a week. A ground magnetometer crew will average 160 stations per week, or about 160 square miles surveyed. Cost figures thus far obtained indicate that the ground survey costs about 40 percent more than the aerial survey, requires about 14 times as long to make and is considered inferior. In difficult terrain, such as is found in southern Florida, the difference in cost and time required would be even greater.

Field Operations

Operational procedures have become standardized with the work day beginning early in the morning. The flight crew, which includes two pilots and three instrument operators, meet with the office Shoran supervisor for a preflighting of the day's operation. Straight flight lines are spaced one mile apart and

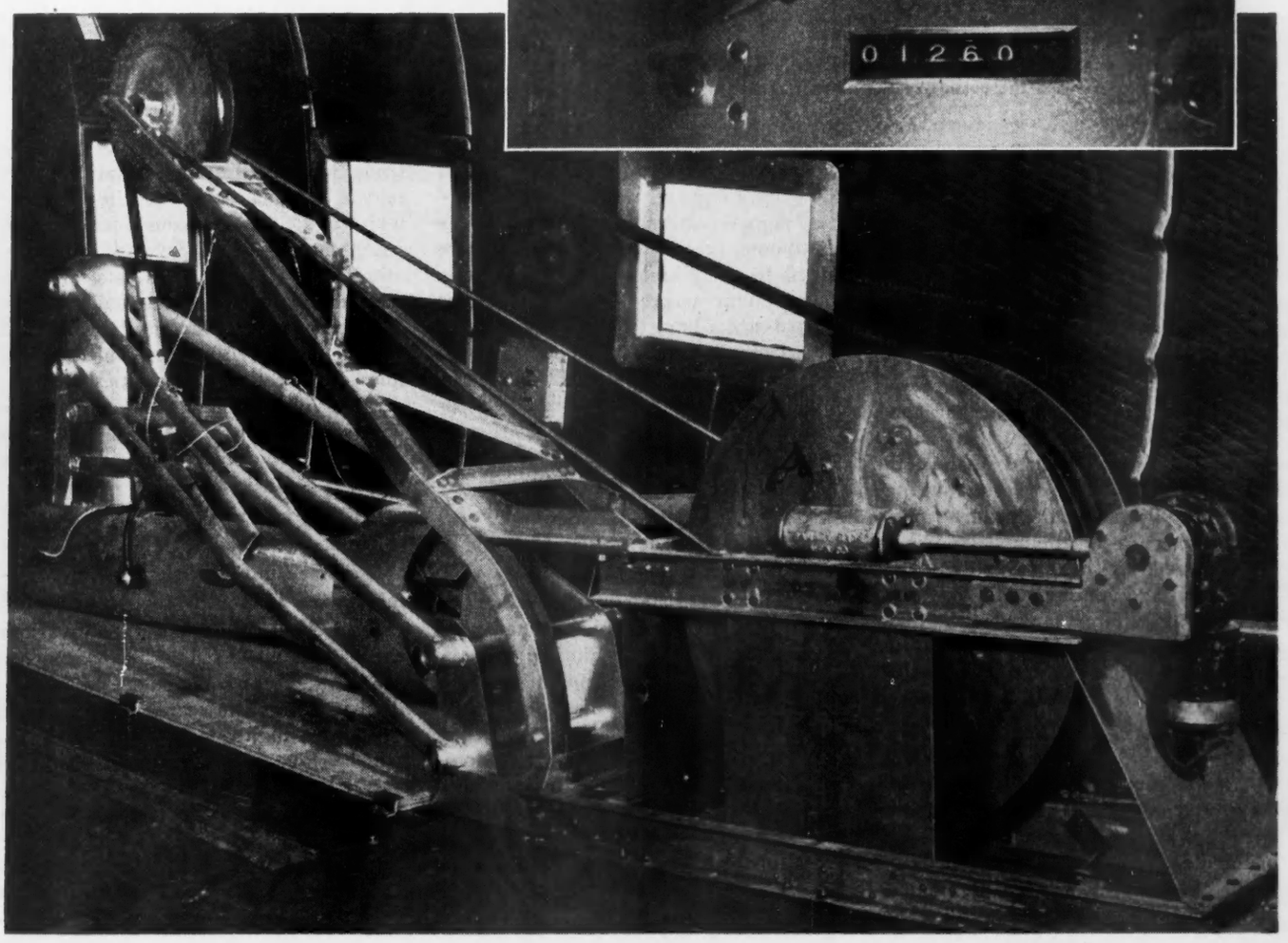


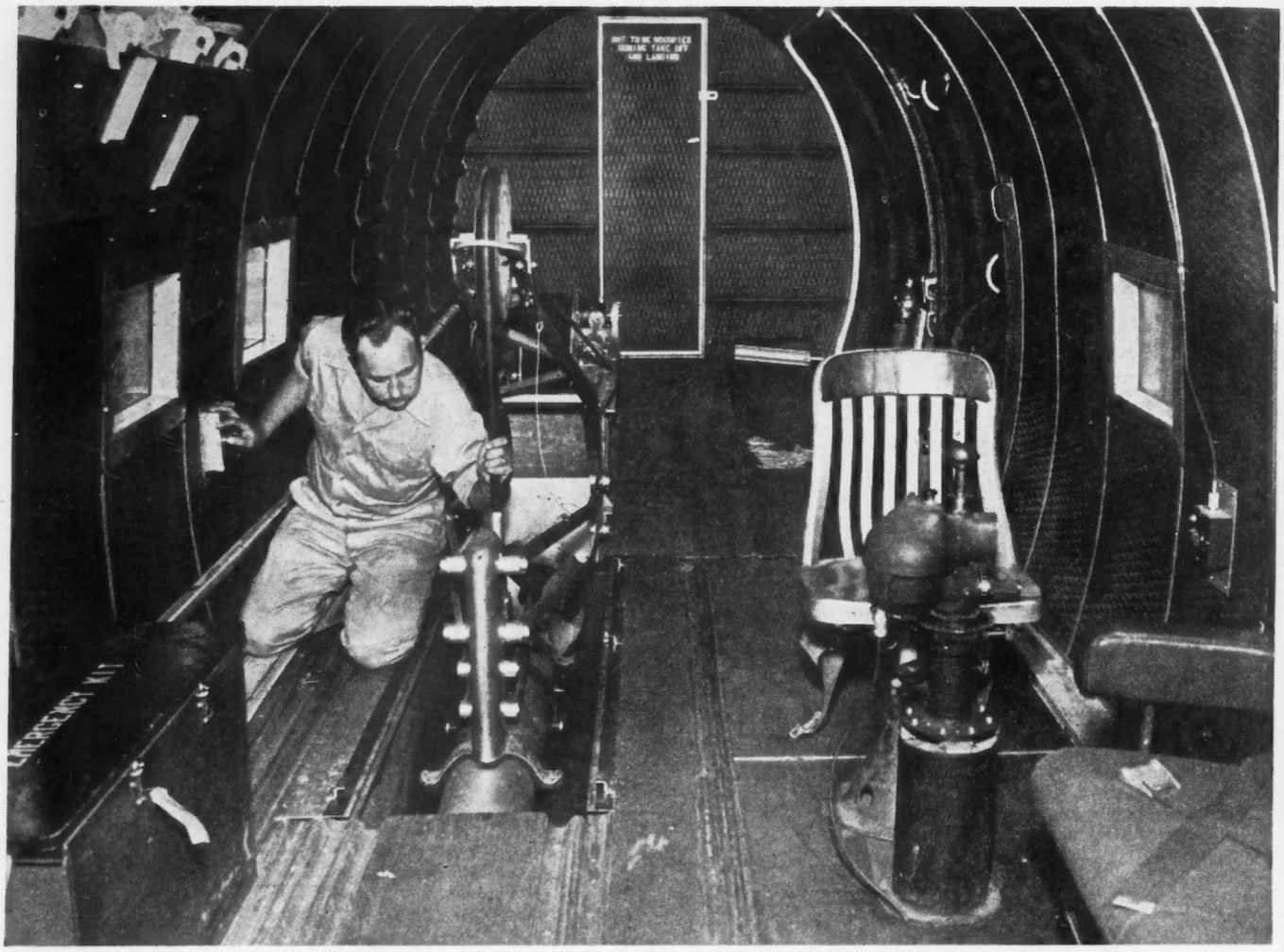
The three instrument operators in the rear cabin of the DC-3 during flight operations. The Shoran operator is at left, immediately in front of the Shoran flight director. The Shoran operator keeps the Shoran (radar) equipment in constant tune with the ground station Shoran units. The flight director gives instructions to the pilot and co-pilot who keep the plane as nearly as possible on a predetermined course. The magnetometer operator is shown at right, making notes on the magnetometer profile record. These notes further aid in correlating the data when plotting the magnetic maps.



Reproduction of two frames of 35 mm. film taken by a Sonne strip camera. This photograph shows the Shoran instrument dials on the unit carried in the airplane. At left is the scope by means of which the operator is able to maintain constant tuning with the two Shoran base stations. At the right are distance measurements in miles. The upper right set of figures indicates the distance from one Shoran base station (38.777 miles) while the middle set of figures indicates the distance from the second Shoran base station (42.694 miles). By means of the radial dial figures, the plotters can estimate the distances to the nearest thousandth of a mile. The bottom figure is called the fiducial number, which is used in correlating the photograph with index marks on the magnetometer profile record.

Airborne magnetometer ejecting mechanism and hoisting equipment. Except for the d.c. electric motor and gear reducer at extreme right, all parts are of aluminum alloy and other non-magnetic materials. Tension in the cable holds the "bird" in the position shown. To lower the magnetometer for use, the subflooring is removed and the unit lowered into a well. Two doors in the fuselage are retracted and cable is fed out. The ejecting mechanism guides the "bird" into the slip stream about ten inches below the ship. From this point on (about 90 to 100 feet of cable is paid out), the "bird" is stabilized aerodynamically. Electric switches beyond the hoisting boom permit one man to lower and raise the magnetometer.





This shows how one man can raise and lower the bird during flight operations. In this picture the bird is being lowered and is actually midway between the floor level and the outside of the aircraft. The depth of the magnetometer well (or the distance between the floor level and the outside of the aircraft) is approximately 24 inches.

extend for a distance of 70 miles or less. The precalculated Shoran data are carefully studied by the flight crew so they will know specifically where they are to fly that day.

En route to the area, the magnetometer is lowered on 90 to 100 feet of cable, and the electronic equipment is permitted to warm up before the survey is started. Near the area to be surveyed, the Shoran flight director begins checking his preflight distance against the Shoran dial readings in order that he may direct the pilot along the predetermined course where a magnetic profile is to be observed. With this preflight data before him and continuous Shoran readings, the flight director guides the plane over its course. This is a difficult job, and to obtain maximum efficiency from the crew, the flight director's position is alternated among the three operators every 1½ hours.

After about five hours in the air, the crew returns to the Sarasota-Bradenton airfield, where the magnetic profile record and Sonne strip film are turned over to the office crew. The films are immediately developed and the Shoran fixes are accurately plotted to provide a record of the plane's flight as well as points where the magnetic intensity was keyed on the continuous record. Magnetic values are added to the Shoran base map at the keyed points where Shoran fixes were plotted according to the photographic data. Contour lines connecting points of equal magnetic intensities complete the preliminary map. In a normal day's operation, the results of the flight are generally checked by the Shoran office crew within 24 to 36 hours after the data are recorded.

Seismic Methods vs. the Airborne Magnetometer

Gravity and seismic methods of exploration have been tried by competent geophysical operators in Florida, but the results have been disappointing. The gravity meter is not as diagnostic an instrument in Florida as it is in the Texas, Louisiana, and Mississippi salt dome provinces. Compared with sediments in salt dome basins, the sedimentary section in Florida is comparatively thin and monotonous, ranging in depths from 3100 feet in north central Florida to more than 14,500 feet in the Keys area. Underneath the Eocene formations from central Florida south to the Keys is found a solid Cretaceous section composed largely of limestones and dolomites. The density contrasts are not sufficiently great, or the anomalies clearly enough defined, to warrant the continued use of the gravity meter unless oil is found in substantial quantities. The diverse terrain conditions make a comprehensive gravity survey of Florida too slow and expensive to consider at this time.

Seismograph methods, both refraction and reflection, are frustrated by unfavorable surface and subsurface factors. Seismic waves created by the detonation of explosives placed in shot holes at various depths are dispersed by heterogeneous sands and coral fragments. A few hundred to several thousand feet below the surface are high velocity limestone strata which serve effectively as a physical shield to divert the energy horizontally and scatter it back to the surface. The seismic velocities do not increase appreciably with depth below this first limestone shield. Because there are not consistent underliers with higher veloci-

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SIZE IN INCHES	HEIGHT WITHOUT FLANGES
6⅝"- 7"	23"
8⅝"- 9"-9⅝"	25⅛"
10¾"-11¾"	27"
12¾"-13⅝"	28½"

Note in the accompanying table the space-saving compactness of Shaffer Double Cellar Control Gates—and then translate these space savings into valuable cellar economy—not only for *one* well, but for *every* well on which the Gate is used *throughout its entire life*. It's a saving you cannot afford to overlook!

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FOOL-PROOF NON-CREEPING RAMS: Positive mechanical screw feed not only assures quick fool-proof ram operation at all times, but also firmly holds Shaffer rams in whatever position they are set *without need for auxiliary locking devices or extra operations!*

WIDE CHOICE OF POWER DRIVES: Shaffer Gates can be operated with virtually *any* type of power—air, hydraulic, steam or electric—*plus* the added safety of complete manual stand-by. All Power Drives are simple to install... and control is centralized at the driller's fingertips!

FAST RAM CHANGES: Shaffer Rams can be completely changed by removing just ONE end cover. Saves time, simplifies changes!

SIMPLE INSTALLATION: Regardless of the type of power drive selected, Shaffer Gates are unusually simple to install without complicated piping, wasted space or cellar clutter. This feature saves time, boosts working efficiency!

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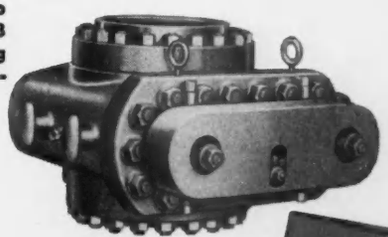

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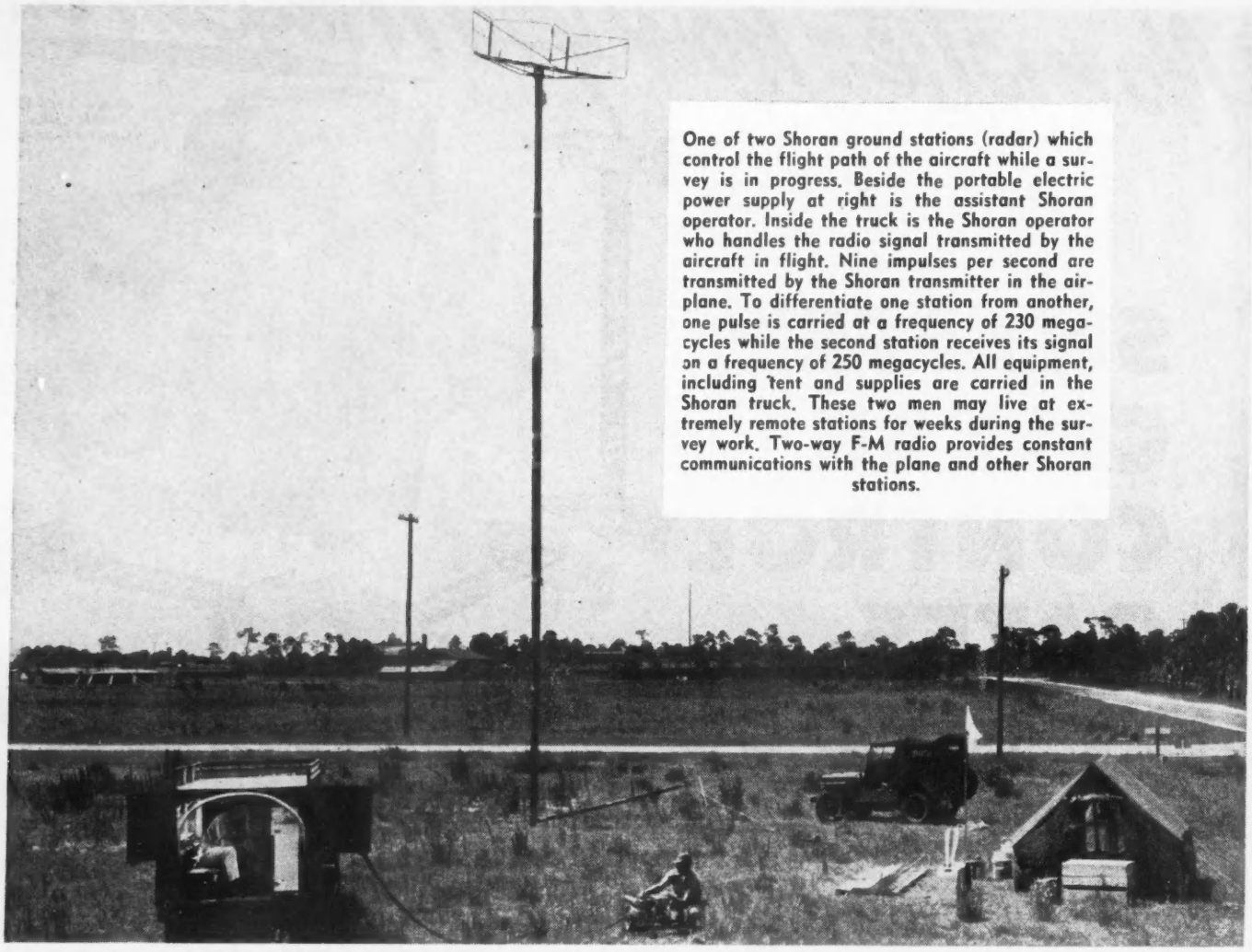


One of two Shoran ground stations (radar) which control the flight path of the aircraft while a survey is in progress. Beside the portable electric power supply at right is the assistant Shoran operator. Inside the truck is the Shoran operator who handles the radio signal transmitted by the aircraft in flight. Nine impulses per second are transmitted by the Shoran transmitter in the airplane. To differentiate one station from another, one pulse is carried at a frequency of 230 megacycles while the second station receives its signal on a frequency of 250 megacycles. All equipment, including tent and supplies are carried in the Shoran truck. These two men may live at extremely remote stations for weeks during the survey work. Two-way F-M radio provides constant communications with the plane and other Shoran stations.

ties, the refraction paths are rather flat, i.e., they are not warped downward appreciably to penetrate horizons at greater depths.

The interval velocities of the limestones and dolomites vary between 12,000 and 18,000 feet per second, the average velocity of the Cretaceous section being about 15,000 feet per second. The higher velocities are probably associated with the dolomite sections, but no refraction arrivals can be correlated with known lithology. The same physical factors spoil the application of the reflection method. There are no strong or consistent density or velocity discontinuities which could serve as reflection horizons. It is difficult to send seismic waves down into the Cretaceous section, and it is more difficult to collect and record the refracted and reflected energy necessary for the mapping of deep structural conditions. Wherever measured, the velocities of the basement rocks are not appreciably higher than the velocities in the Cretaceous section; therefore, the basement rocks cannot be mapped with the seismograph. Due to the admitted failure of the seismic methods, Gulf is trying the aerial magnetometer as another geophysical means of exploring the state of Florida.

Because seismic methods have yielded unsatisfactory results in Florida, the airborne megnetometer is looked upon with the hope that it will provide sufficient data from which likely oil areas may be selected for investigation. After the observed or preliminary magnetic map has been plotted in the field office, volumes of calculations must be made before the finished maps are drawn. From these maps, geophysicists and geologists interpret their meaning into terms of igneous basement rock. For it is the magnetic materials in these rocks which cause changes in the earth's magnetic intensity from one location to another.

The shape, size, and probable depth of these igneous masses are very important to the geologist. With a graphic picture of these masses, he must reconstruct what might have happened in the sedimentary layers above the basement rocks as a result of earth movements. By reconstructing this picture, the geologist and geophysicist can more logically select prospective structures which are likely to contain oil.

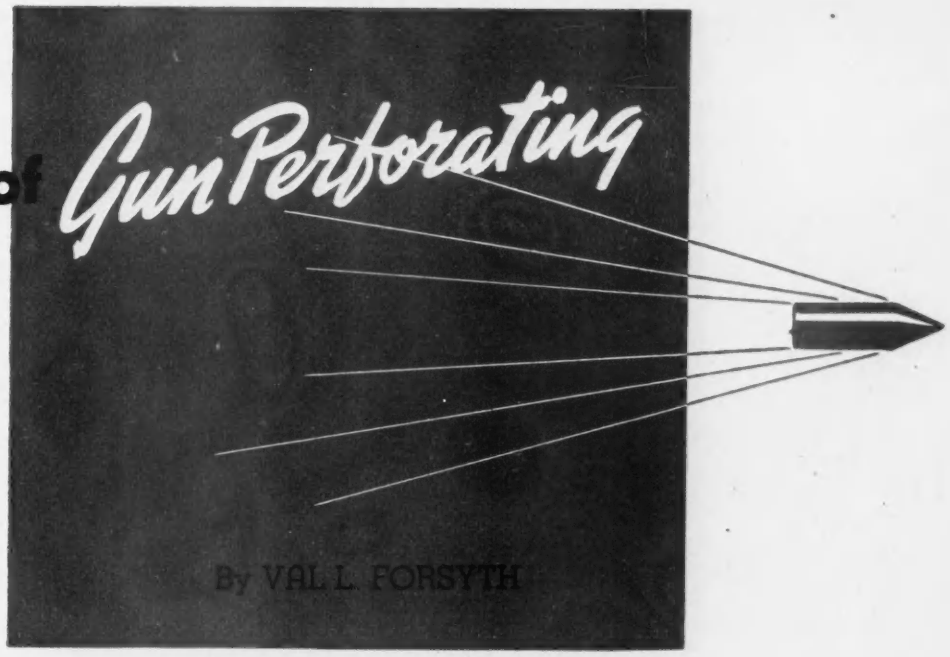
Gulf Refining Company's State of Florida 1, located midway down the Keys, was drilled to a total depth of 15,455 feet without encountering basement rock. In Highlands County of southern Florida, Humble Oil & Refining Company struck basement rock at 12,985 feet, while halfway up the state in Lake County, a test well was drilled into granite at 6129 feet. In Alachua County of northern Florida, Tide Water Associated Oil Company drilled to basement rock at a depth of only 3150 feet. This information indicates a deepening of the basement rocks from north to south, with basement rock far below 15,000 feet at the southern tip of Florida. These known data on basement rocks will be extremely valuable in correlating the magnetic maps with the known geology of the area.

The ability of the airborne magnetometer has been successfully proven in other areas. Its introduction in Florida is heralded with hope and the expectation that it will give the oil industry there a much clearer picture of subsurface conditions so that a more intelligent selection of drilling sites may be made. The percentages of successful wildcats in the future will measure the airborne magnetometer's success in Florida.

ACKNOWLEDGMENT

The writer gratefully acknowledges the information and photographs furnished by Gulf Oil Corporation and Gulf Research & Development Company, and by individual members of these two organizations, particularly by Walter Osterhoudt of Houston.

A Study of Gun Perforating



EVALUATION OF various factors affecting gun perforating enables the equipment to be used to maximum advantage. In this series, the author reports on an extended series of tests made by his company with the cooperation of oil company personnel. Results obtained indicate optimum combinations for various well requirements.

Part 1—The Effect of Gun Perforating Upon Casing

SINCE 1932 there has developed within the petroleum industry a growing utilization of the gun perforator in well completion and recompletion work. Much has been written concerning the application of this tool to production problems, yet there is a marked lack of general knowledge concerning actual gun performance. It is the writer's intention to openly discuss those details of gun perforator design and performance which may prove helpful to people of the industry in applying this tool to their problems.

The information here presented is drawn from the research files of a service company but reflects the activity of oil companies who have spent a great deal of time and money in acquiring such information. To these companies we express our sincere appreciation for their sizable contribution to the development of gun perforating equipment.

GUN PERFORATING CASING IN TENSION

In tests conducted with oil company personnel two 5½-inch, 17-pound, J-55 casing nipples were made up with three collars, one between them and one on each end. Casing clamps were fastened on each end of the joint and hydraulic jacks placed between the two arms on each side of the pipe. A 20,000-pound force was applied by each jack, with a resulting tensile load of 40,000 pounds on the casing.

While in strain the pipe was gun perforated twice to determine if casing perforated in tension will split. One shot was placed in the collar and one in the nipple using 15/32-inch bullets in a 4⅛-inch gun with a standard powder load.

Figures 1 and 2 illustrate the placement of shots and results obtained. The results indicate that, contrary to general belief, casing in tension is not particularly susceptible to splitting when gun perforated with selectively fired gun equipment. This is further borne out by other information available from research files. Other tests have shown, however, that certain of the lighter grades of pipe will fail whether or not they are in tension.

Discussion of Results

These results, when converted into terms of pipe completion programs, have a very important bearing on the over-all program. A frequently used method of completion is to pump cement behind the casing, and, after waiting a suitable length of time for cement to set, to lower casing at the surface so as to reduce the weight being held by casing adjacent to the surface. In this type of completion the casing at total depth is usually in a relaxed condition, while part of the casing cemented in place may be permanently fixed in a strained position.

Results of mutually conducted test

About the Author

VAL L. FORSYTH, assistant chief engineer for Lane-Wells Company, received his degree in petroleum engineering from Texas A. & M. College in 1937. He was employed by Otis Pressure Control for one year and then joined Lane-Wells Company. In 1939 he was made district engineer for the Illinois District and then promoted to division engineer for the Mid-Continent Division. He was named assistant chief engineer in 1946.

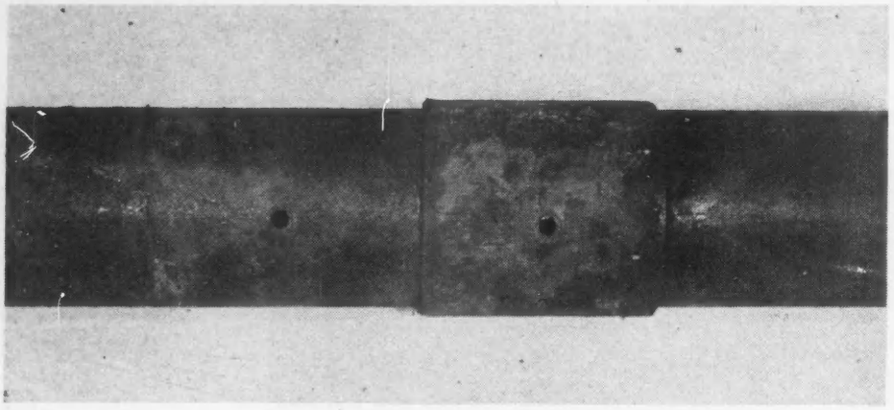


FIGURE 1. Casing and collar gun perforated in tension (40,000 pounds).

operations reveal that casing destruction is not aggravated by applying tension to the casing. In plug-back completions involving selective gun perforating of standard grades of casing, the matter of the casing being in tension appears to be of small consequence.

CRACKING, FRACTURING, AND ACCUMULATION IN CASING

A series of tests was conducted to determine the nature and extent of cracking, fracturing and burr accumulation in casing. To explore the possibilities of conducting surface tests which would produce results representative of subsurface tests, subsurface tests were conducted by oil company personnel and correlated with mutually conducted surface tests.

Surface Tests

Surface tests utilized identical "standard" test barrels as test samples. The casing to be perforated was set inside a very thin eight-inch sheet metal form representing the bore hole. The formation surrounding the bore hole consisted of an aggregate of one part high early strength cement to two parts river sand with the lowest practicable water-cement ratio.

All of this material was set inside a 55-gallon steel drum as shown in Figure 3. The compressive strength of the concrete was near 5000 pounds per square inch and the tensile was about 485 psi.

At the time of these tests the compressive strength of the neat cement was 6000 psi, with a tensile of 402 psi. It is believed that both neat cement and concrete "formation" were approaching their ultimate maximum strengths.

Subsurface Tests

In subsurface tests a section of 5-inch, 18-pound J-55 casing was cemented inside 7-inch, 28-pound N-80 casing. The sample was run on a string of 5½-inch casing to a depth of about 6500 feet under 10 pounds per gallon mud. The neat cement strength was judged to be approximately the same as the neat cement used in surface tests.

Gun Equipment

Gun perforating equipment consisted of a selective firing gun utilizing a short barrel (3⅝-inch outside diameter) and a long barrel (4⅛-inch O.D.). See Figure 4. Powder charges and all ballistic conditions throughout the test were either standard or reduced according to the individual test objective.

Flat nose bullets, ogival nose bullets, conical nose bullets, and jacketed bullets of all types were tested with various combinations of guns and powder charges.

Discussion of Results

The subsurface tests were directed primarily toward determining operational procedures, penetration under subsurface conditions, and the comparative correlation of surface results with subsurface results. Thus, the data acquired concerning details of pipe conditions are not as detailed as those acquired in surface tests. The following facts were determined concerning subsurface tests with selectively fired equipment:

1. No casing destruction resulted under subsurface conditions.
2. No cracks occurred in the casing.
3. Burr characteristics with unjacketed bullets were somewhat sharper but otherwise the same as those produced at the surface.
4. Burr characteristics with jacketed bullets duplicated surface results.
5. There were no bullet ricochets, and results were identical with surface results.

Since the test results established the comparative correlation of subsurface with surface tests, the following discussions and data will be confined to surface tests.

Flat nose bullets are not suited to normal perforating service. The hole and burr characteristics are not satisfactory for any standard gun, powder or bullet size combination. There are, however, certain special applications where they are usable. For example, when perforating a string of tubing where the outer casing must not be damaged, controlled penetration is quite essential and the flat nose bullet is well adapted.

Bullet velocity has an effect on burr characteristics. A sharp burr can result with the short barrel; yet, when the barrel length is increased with corresponding increase in bullet velocity the burr characteristic is improved.

Powder charge is a factor influencing bullet velocity with any given gun design. Designs vary from selective to simultaneous, from electrically fired to flame fired, and even vary within a given classification as a result of using or not using shear discs at the base of the bullet or fluid seals at the muzzle end of the barrel. Therefore, any statement relative

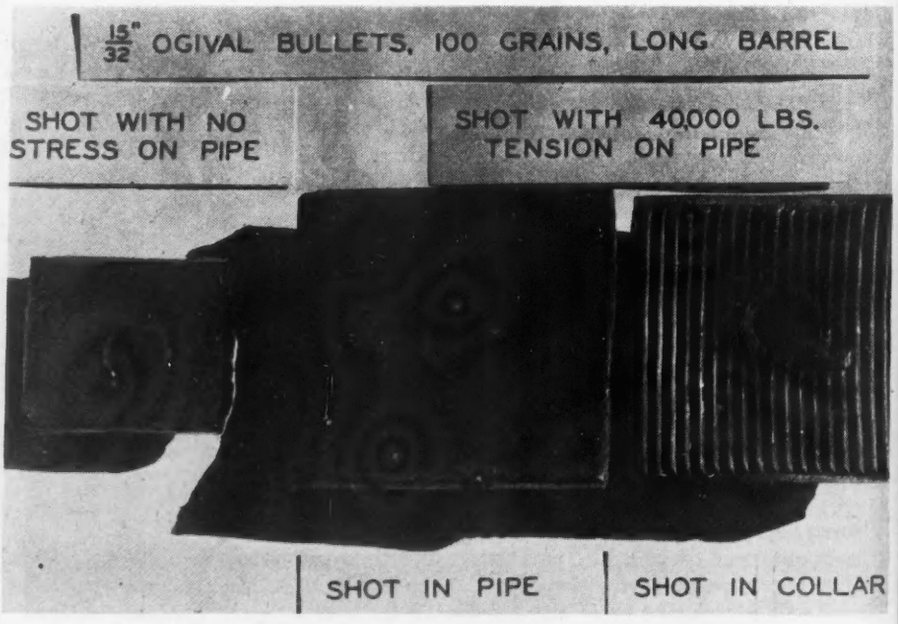

15/32" OGIVAL BULLETS, 100 GRAINS, LONG BARREL
SHOT WITH NO STRESS ON PIPE
SHOT WITH 40,000 LBS. TENSION ON PIPE
SHOT IN PIPE
SHOT IN COLLAR

FIGURE 2. Samples of casing gun perforated in tension.

to any one of these and many other details of gun design cannot be correctly evaluated unless it is further explained by describing details of the individual design.

Some designs require the use of more powder to compensate for pressure losses which are inherent with the particular design. Simularly, other gun designs require additional powder charge and barrel length in place of using a shear disc to delay bullet travel during initial powder combustion.

At this point it must be emphasized that casing size imposes limitations on barrel length, powder charge, and other critical design features built into gun perforator equipment. A proper design is one in which all these and many other factors have been considered and carefully weighed.

Combustive pressures within the firing chamber approach 200,000 psi. A well-balanced design keeps this volume of gas at a minimum so as to create minimum hazard in the well bore. Maximum utilization of barrel length is acquired through the use of delayers, such as shear discs; and in some designs a fluid seal is used to permit maximum bullet velocity prior to the bullet meeting well fluid. These and a large number of other design details are a part of gun perforator development.

FIGURE 3. A standard test barrel.

Bullet Size

Gun perforator equipment, as a rule, is a carefully balanced ballastic design.

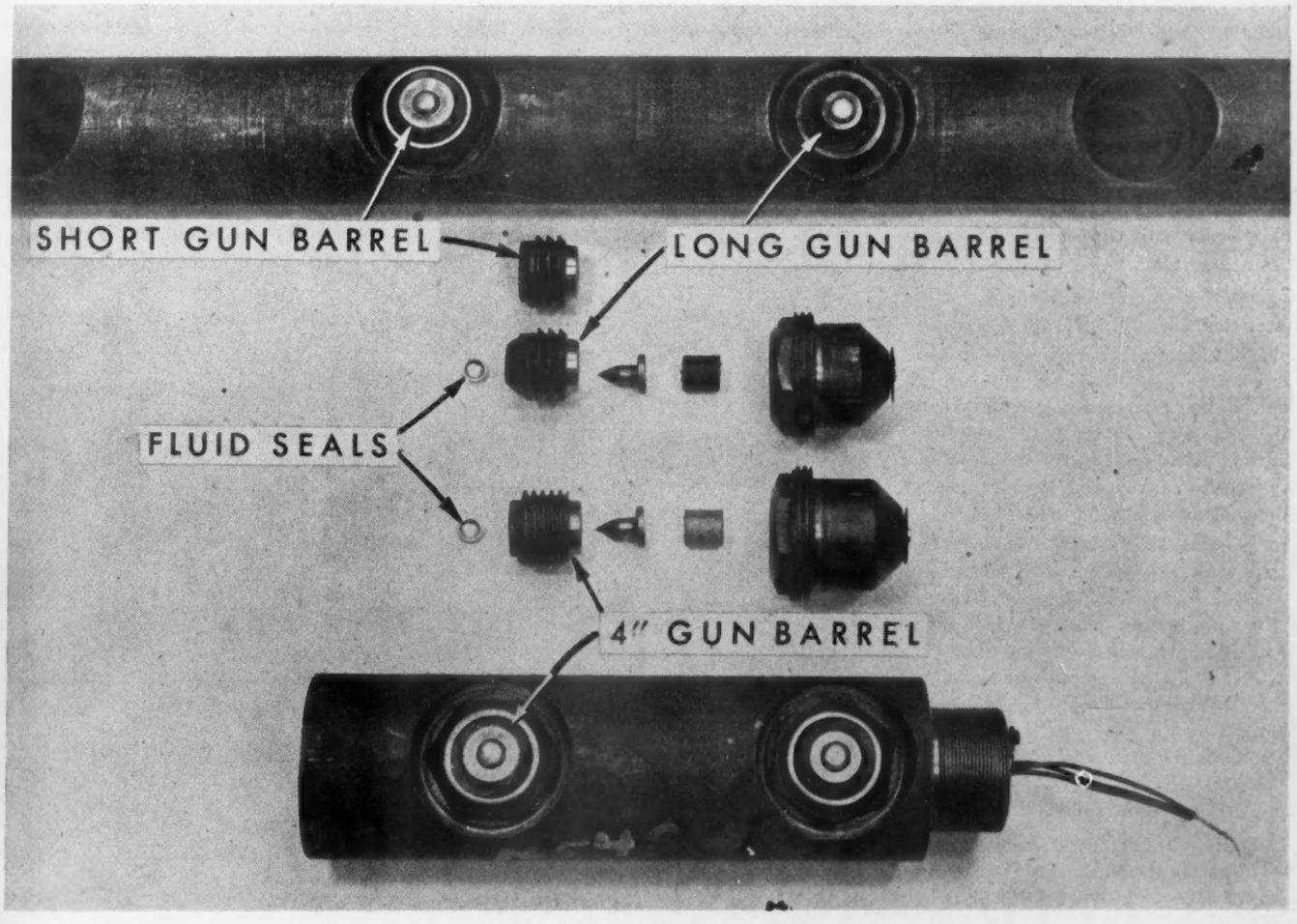


FIGURE 4. Details of gun assembly.

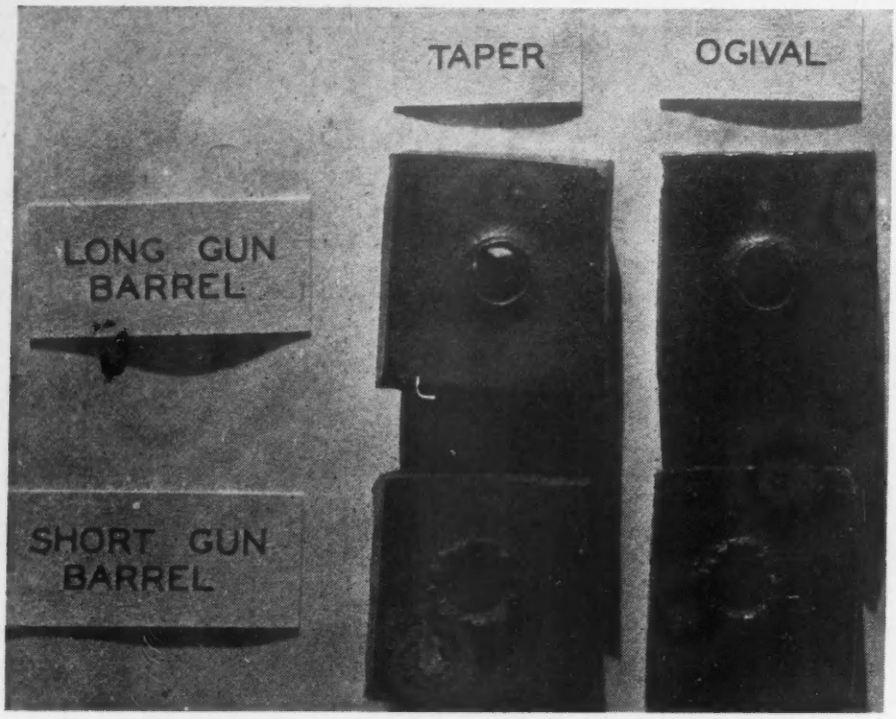


FIGURE 5. Effect of bullet shape upon burr formation.

The bullet size recommended for each size of gun is carefully considered, particularly from the standpoint of penetration. Deviation from this balanced arrangement can be accomplished but always at the sacrifice of some other feature of design.

1. A large diameter bullet is usually heavier than a small bullet. Acceleration is slower and resistance to movement in fluid or casing is greater. Velocity is usually less, with the result that larger burrs are formed.

2. Small diameter bullets are usually lighter than large bullets. Acceleration is rapid but deceleration is also quicker. The reduced bore size creates an orifice effect. Velocity is usually a little greater but high peak pressures within the firing chamber, as a result of the orifice effect, may require a reduced powder charge and penetration is affected.

In general, this means that any comparison of small bullets with large must be on the basis of equal peak pressures in the combustion chamber. With this consideration it will be found that each gun design has an optimum balance and any deviation from this balance is accomplished at the sacrifice of some other ballistics feature.

Changing Bullet Size

Changing bullet size appears to have less influence upon casing burrs than other factors such as gun position, barrel length or bullet velocity. Note in Figure 6 the difference in burr characteristic resulting from changing various features of the gun, such as barrel length and bullet shape.

Gun position with respect to the casing wall has a marked effect on burr characteristics. (See Figures 7 and 8.) When the gun is placed against the casing wall or centered in casing the burrs are quite smooth. When placed well away from the casing or tangent to the pipe surface, larger burrs are formed.

A centering device is a logical but not necessarily practical utilization of this knowledge because most operators are asking for increased running speeds through increasingly heavy fluids, and any centering means will reduce operating speeds.

It may be seen from Figures 5, 7, and 8 that gun position has more effect on burr characteristics than bullet size. Since bullet size has only minor effect on burr formation, and since other variables have greater influence, it is concluded that no consideration should be given to changing bullet size for purposes of burr elimination.

Casing Type

Casing type has a minor effect on burr characteristics. Figure 7 illustrates results obtained when using N-80 casing. The burrs can be compared with those in the more ductile J-55 (Figure 8).

N-80 casing undoubtedly presents a more difficult perforating condition than J-55 casing, not because of burr characteristics, but primarily from the standpoint of penetration. A single string job is not critical unless the amount of neat cement behind the casing is unusually thick.

A double string job presents a more difficult problem in penetration. On such jobs a larger gun or special powder charge may be required. If such conditions are discussed in advance the service company can recommend the proper equipment to obtain optimum results.

Casing burrs can be eliminated. It has

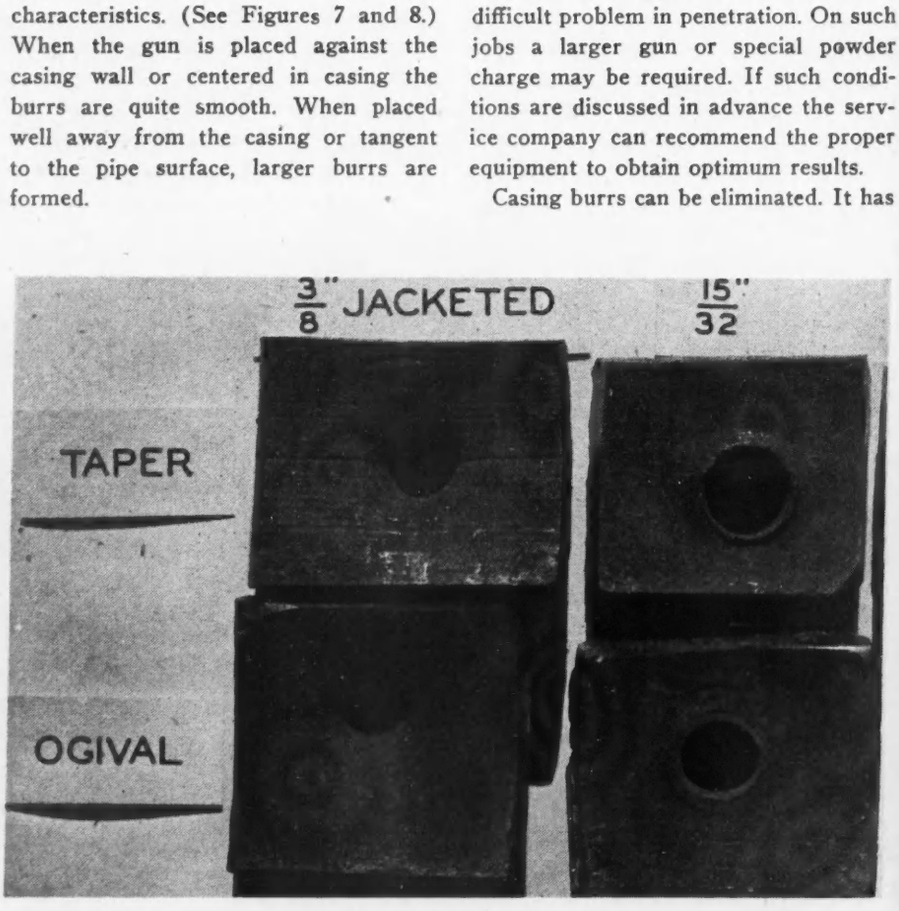


FIGURE 6. Effect of bullet size, burr free caps, and bullet shape on burr formation.

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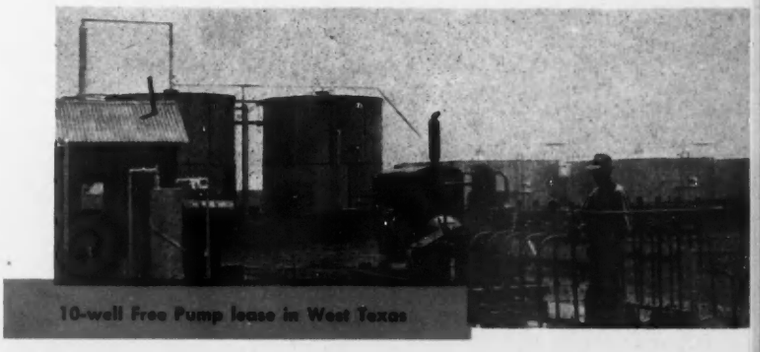

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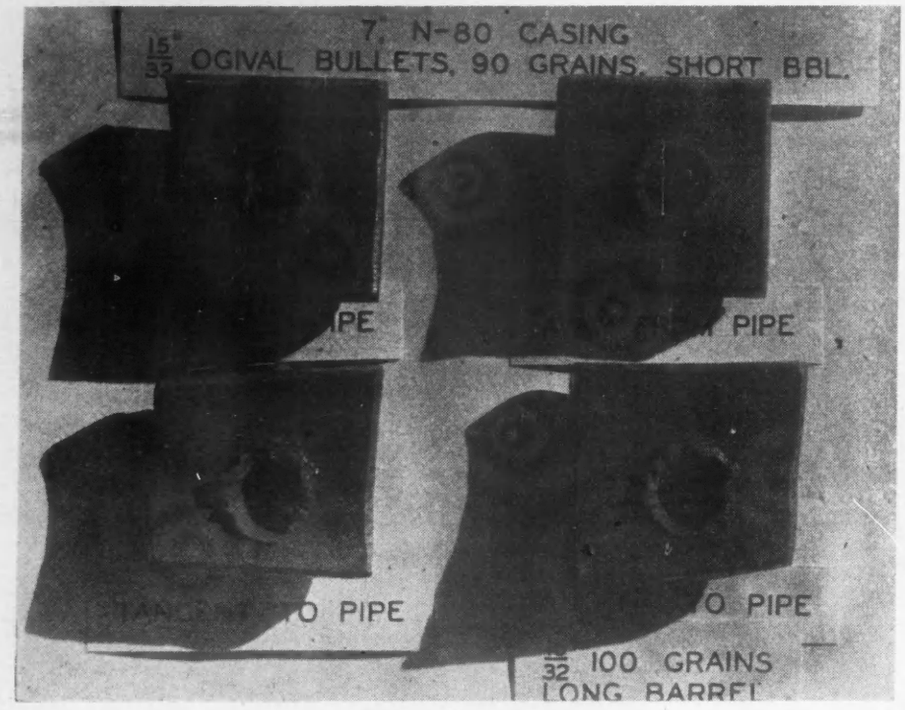

FIGURE 7. Gun position and the effect on burr formation. (Small gun in large casing.)

long been recognized that a part of the available gas energy may be used to smooth out burrs. This type of perforating has been available for a number of years but is not generally recommended because of the decrease in penetration which necessarily results. Burrs are usually eliminated by the use of caps or sleeves over the bullets. A considerable loss in penetration results. There is no loss of efficiency or power because the available power is merely used to accomplish burr removal as well as bullet penetration. But there is a reduction in penetration.

Effect of Using Sleeves

Figure 6 illustrates the effect of using sleeves to reduce burr characteristics where the casing samples are well supported by neat cement. In other tests, conducted in past years, it has been found that caps placed over the bullet, or sleeves around the bullet can cause small cracks in unsupported casing.

Bullets do not ricochet. There have been questions concerning the possibility of bullets striking casing at an angle so as to ricochet. In some instances operators have contended that this was the explanation for bullets returning to the well bore.

Extensive tests have been conducted to prove the improbability of bullet ricochet occurring in a well. Recently one of the major companies set about to study this point. The results of these tests were as follows:

The 3⅝-inch OD gun was located inside 5½-inch J-55 and 7-inch N-80 casing so as to cause a maximum deflection condition. Figures 7 and 8 illustrate results obtained. It should be realized that a 4-inch gun is usually used in 5½-inch casing and a 5¼-inch OD gun in 7-inch casing. Consequently the test condition is worse than would normally occur in a well, yet, no ricochet occurred.

In addition to the observed results shown in Figures 7 and 8 it should be explained that the clearance between gun OD and casing ID is usually less than the bullet length. It is not possible to turn a bullet in the space provided.

Laboratory Tests of Experimental Casing

Conclusions drawn from observations of test samples or from pictures of samples can very possibly be in error, unless the full details of the test procedure are made known and their influence upon results fully explained by a suitable ballistics expert.

It is possible to alter test conditions to obtain some desired result. Tests have been performed for pipe manufacturers with the intent of determining the relative ductility of one kind of casing as compared to another under the stresses imposed by gun perforating. If these tests were performed under conditions that would not harm the samples, little knowledge would be imparted to the pipe company. Test procedure, therefore, consists of setting up conditions which will usually result in casing cracking. Both standard and experimental grades are treated under these conditions.

Under such conditions a study of burr characteristics, penetration, etc., would not be proper. Tests of this nature should not be confused with the type of test discussed in this article where the objective was to duplicate as nearly as possible true subsurface conditions.

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[1] George F. Turechek, "Burr Characteristics of Gun Perforated Casing," Tomorrow's Tools —Today!, Vol. XII, No. 1, First Quarter, 1946.
[2] S. C. Oliphant and R. F. Farris, "A Study of Some Factors Affecting Gun Perforating," Petroleum Development and Technology, Vol. 170, 1947.

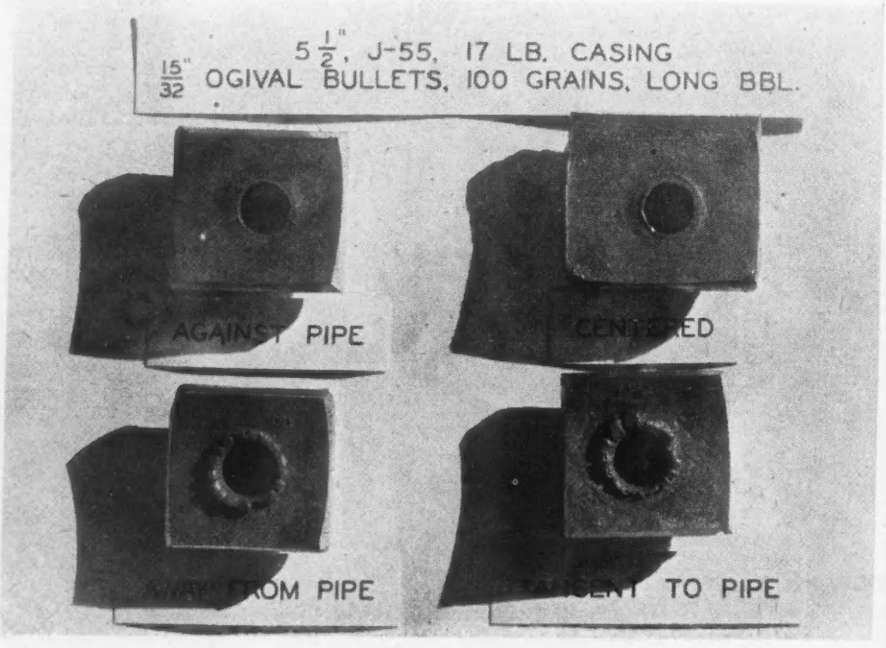

FIGURE 8. Gun position and the effect on burr formation. (Small gun in medium large casing.)

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Considerations in Effective Oil Production

By HARRY M. RYDER

Obstructions in a pay zone can trap much valuable oil if production is managed on the basis of uniform reservoir conditions. This article discusses various types of obstructions and recommends procedures for obtaining optimum returns. Proper drilling and adequate testing of first wells to reach a new pay are discussed in their effect on ultimate exploitation, and competent testing is stressed.

AS HAS been discussed previously,[1,2,3] the problem of most effective oil production from a sand is that of removing as much oil as possible from each oil-containing pore, consistent with the sound economics of the operation. The removal of oil from a pore presupposes access of the driving agent to that pore, whether the agent be gas or water. It has been shown[3] that a very slow water drive through oil-wet sand may result in bypassed pores or clusters of pores. To such pores the driving agent does not have access and oil is not removed from them.

On a much larger scale, the driving gas or water may have no access to areas of otherwise valuable oil sand, areas of from a few square feet to acres in extent. In some cases the difficulty will be limited to a part of the total pay thickness. In other cases the entire pay thickness may be involved. In every case an obstruction of some sort is present. The obstruction may take any of the following forms:

1. Geological anomaly, such as a fault or impermeable joint.
2. Absence of the pay sand bed.
3. A very low-permeability area in the bed.
4. An area into which water has moved.

Wherever such obstructions exist, they are potential causes of the permanent trapping in the sand of otherwise recoverable oil. In some cases they cause the "dragging out" of the oil production over a long period of time and thereby increase the cost of production.

If an obstruction exists and nothing can be done about it, it is merely an unpleasant and perhaps expensive circumstance in the operation. But in many cases the situation can be met to the advantage of the operator.

Types of Obstructions

Many obstructions occur in a part of the pay thickness only. In such cases the fluids may move over or under the obstruction, provided the permeability normal to the bedding is sufficient for the purpose. Not infrequently, however, fluids will not move in this manner. They will not do so in the Bradford Third sand or in the Bartlesville "shoestring" sands of Kansas. Interbeds of shale or mica, some exceedingly thin and almost invisible, prevent appreciable movement of fluids from one bed to another. For all practical purposes, in such sands in the field fluids can move only parallel with the bedding, regardless of laboratory evidence to the contrary. This type of formation will be considered first.

OBSTRUCTION TYPE 1: Faults, impermeable joints, etc. These obstructions are not common in American oil fields, but they do exist. Near the south edge of the Bradford field the shoreward side of an offshore bar, embedded in sand, forms such an obstruction, against which oil had been concentrated by a water drive from seaward. It was identified from test-well data, the oil saturation being very high in the high-permeability sand of the bar and very low in the low-permeability lagoon sand. The treatment is to arrange the flow paths so that the oil will be effectively driven to producing wells without attempting to force it through the obstruction. This is accomplished through the selection of well locations in a manner discussed later.

OBSTRUCTION TYPE 2: Local absence of pay sand bed. This condition is always present at the limit of a sand bed. Wilson[4] and Stephens[5] have shown that the limit of a sand bed does not always coincide with the limit of pay. At places one pay sand layer will extend beyond the limits of another overlying or underlying it. Also, a sand layer may be absent over a small or large area entirely within the limits of a field. Obviously the treatment necessary is similar to that for Obstruction type 1: to arrange the direction of fluid movements, naturally or artificially driven, so that they will sweep the entire pay area without interference from the sand-bed limits.

OBSTRUCTION TYPE 3: Very-low-permeability area in the bed. This condition is not uncommon. Where a "tight" area intercepts the path of intended fluid flow, the least harm done is a slowing down of the fluid movement and consequent delay in oil production. More harm is done in cases where the "tight" area serves to deflect or even to block a planned movement of fluid. In some cases, water may move around both sides of a low-permeability area and close beyond it. This is especially likely to happen in an oil-wet sand. The result is oil trapped in the sand and lost.

"Tight" areas in a sand bed are a result of the selective laying down of fine material (natural sorting) due, perhaps, to the nature of local currents present in the water at the time of deposition. They may be of almost any pattern. Figure 1 is a map of a part of the Coit property in the Bradford field. On the map are contoured the measured permeability values of a single continuous sand layer. This is the distinctive chocolate-colored "black" sand layer referred to by Stephens,[5] and is apparently continuous over thousands of acres. The contouring was done from test data (fluid content as well as permeability) from 74 tested wells located as indicated on the map. Within the contoured area the sand layer varies in thickness from 11 inches to almost three feet. The arithmetical average sand thickness at the 74 wells is 1.58 feet. The arithmetical average permeability is 49.4 millidarcys, measured.

Within the contoured area of 84 acres, four "tight spots" are present, with permeability values less than two milli-

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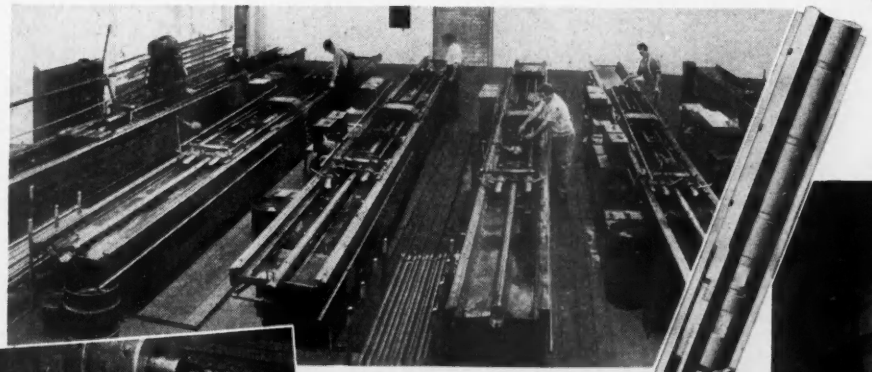

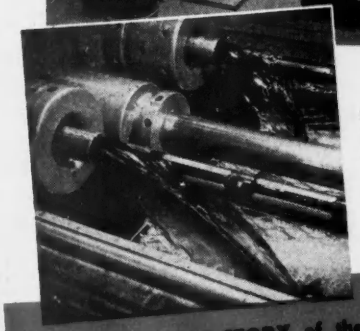

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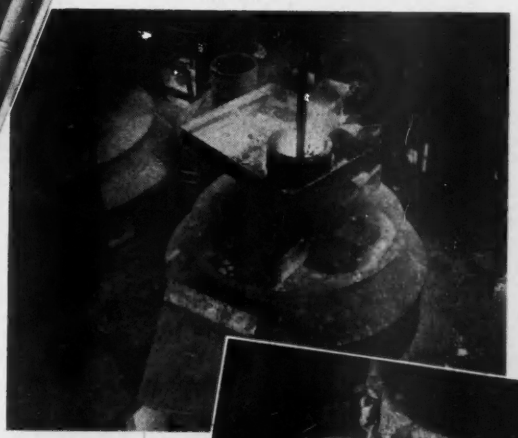

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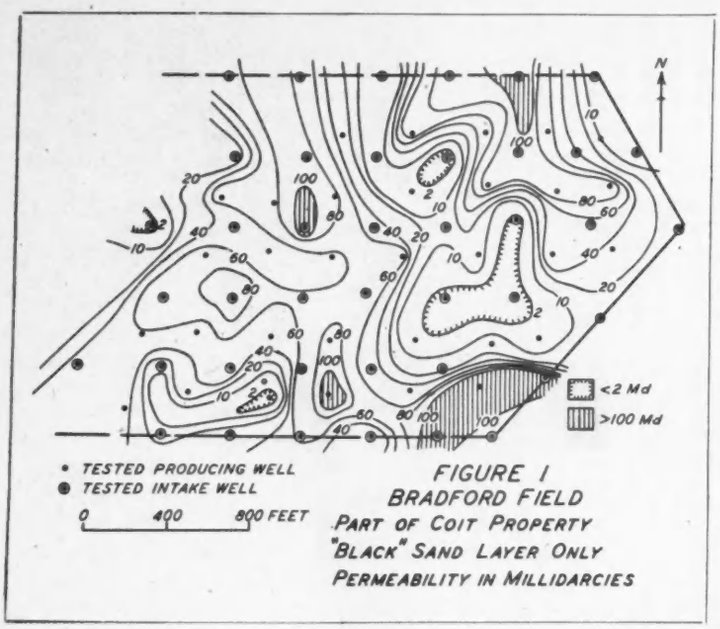


FIGURE 1
BRADFORD FIELD
PART OF COIT PROPERTY
"BLACK" SAND LAYER ONLY
PERMEABILITY IN MILLIDARCIES

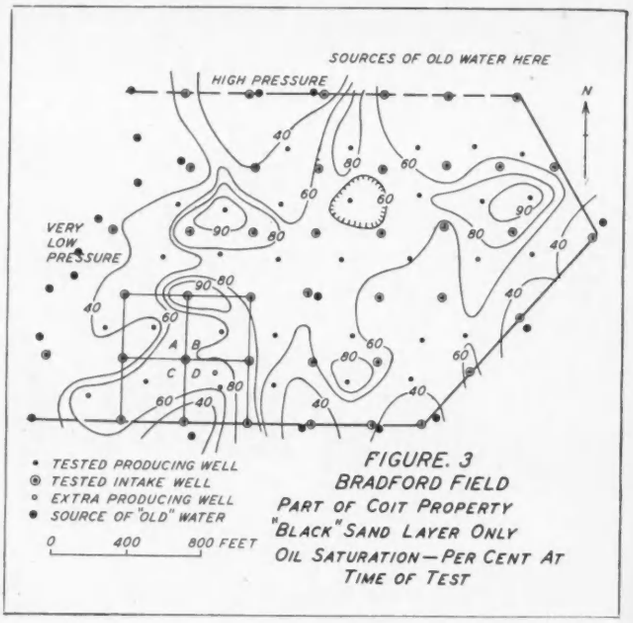


FIGURE. 3
BRADFORD FIELD
PART OF COIT PROPERTY
"BLACK" SAND LAYER ONLY
OIL SATURATION—PER CENT AT TIME OF TEST

darcys. Also, there are present four areas with permeability values of more than 100 millidarcys. If a fluid in this sand layer, driven by a sustained constant pressure, were to enter the north side of the property, it is to be expected that the fluid front would become highly irregular in the course of its southward progress across the property. With no interfering wells, it is probable that a tongue of the fluid, entering near the west end of the north property line, would move southeastward through "open" sand and join, to the southeast of the property, with a tongue of fluid entering the property near the east end of the north property line. If that should happen and if the fluid were water, an area of "tight" sand of some acres extent would be bypassed and all oil within it trapped. Actually, the property was developed for high-pressure water flooding and the variations in permeability were mostly compensated for by means of selective shooting.

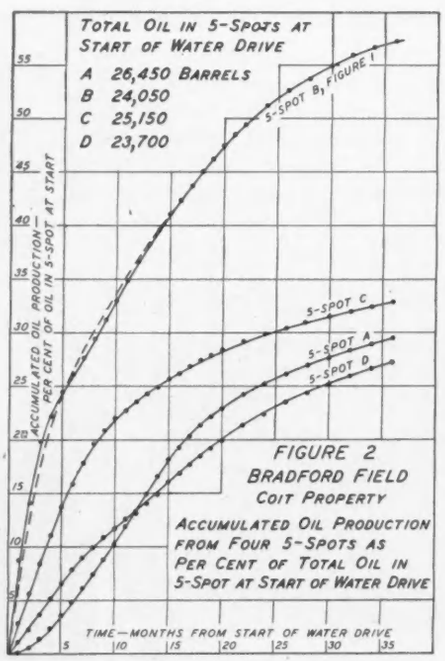

TOTAL OIL IN 5-SPOTS AT START OF WATER DRIVE
A 26,450 BARRELS
B 24,050
C 25,150
D 23,700
5-SPOT B, FIGURE 1
5-SPOT C
5-SPOT A
5-SPOT D
ACCUMULATED OIL PRODUCTION PER CENT OF OIL IN 5-SPOT AT START
TIME—MONTHS FROM START OF WATER DRIVE

FIGURE 2
BRADFORD FIELD
COIT PROPERTY
ACCUMULATED OIL PRODUCTION FROM FOUR 5-SPOTS AS PER CENT OF TOTAL OIL IN 5-SPOT AT START OF WATER DRIVE

Tight Area Present

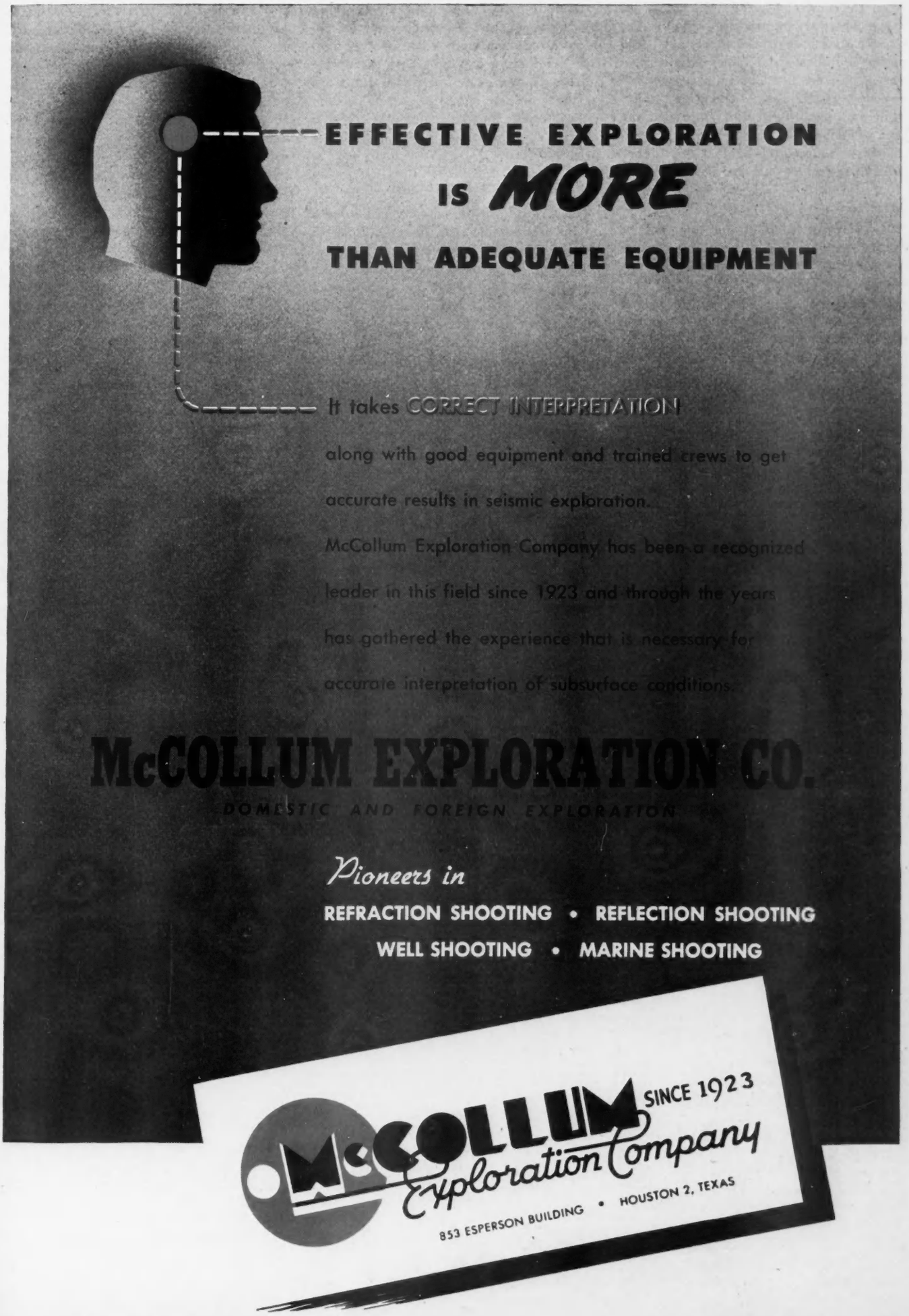
In 5-spot C, located near the southwest corner of the contoured area, satisfactory compensation was not possible. Within this five-spot, a long, narrow, hook-shaped "tight" area is present. None of the wells of five-spot C penetrates the very-low-permeability part of the "tight" area. In five-spot B, adjoining five-spot C to the northeast, no "tight" sand area exists. The total oil content of the two five-spots was almost the same at the time of drilling. The oil-production experiences from the two five-spots were very different. In Figure 2 are presented the oil-production curves for these five-spots. The exceedingly high oil-production rate experienced at five-spot B during the first few months was caused by the release of supersaturated gas previously dissolved in the oil. But this extra energy was dissipated during the first few months of operation and had no effect on the accumulated oil production after about 12 months of operation. By the end of three years' operation, 5500 barrels more oil, 66.6 percent, had been produced from five-spot B than from five-spot C. It is evident that the difference will continue and probably increase slightly to the end of operation. As will be shown later, the great difference in operating experience is not due entirely to the presence of the "tight" spot in the sand, but that is an important factor.

In this case there is little now that can be done profitably about it. But elsewhere in the property, wherever "tight" sand was encountered, the situation was met through the size of the shot used opposite that sand. Using the same pressure, fluid will enter or leave the sand at a well almost 15 times as rapidly if the well is shot with nitroglycerine in 5½-inch-diameter shells as it will enter or leave that same well if no shot is used. This is true regardless of the length of the shot, provided only that the shot extends for at least two feet above and below the sand layer. Therefore, in cases where the presence of "tight" sand is revealed through testing, proper selective shooting can to that extent compensate for that unfavorable condition. Where such compensation cannot be made, either redrilling or an accepted loss is necessary.

Figure 3 is a map of the same area represented in Figure 1, but on which have been contoured the oil-saturation values (as of the time of drilling) in the same "black" sand layer. The contour pattern is a result not only of the permeability pattern, but also of the locations and timing of the sources of water previously driving into the area and of the resultant "squeeze" set up by these drives. Secondary water first entered the area from the west through the numerous sources indicated. This drive was followed by a small, very slow-moving drive originating just southeast of the center of the area, the result of a casing leak at the indicated source. Later, additional sources were provided on the south and east property lines and at various locations on and a short distance north of the north property line.

Drive from the West

The drive from the west concentrated a large volume of oil (from without the area) in the "open" sand in the west central part of the area and against the "tight" sand in the north central part and in the southwest part. The water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from the central leaking well could not move westward appreciably against the oil already concentrated there, but it did move southeastward. The drives from the north and east concentrated oil between them and against the large "tight" sand area in the east-central part of the area. The drives from the south moved oil where they could, against the "tight" sand in the southwest and against water from the "leaker," as will be discussed later.

By keeping in mind the sequence of events responsible for the oil concentrations, a study of the two contoured maps reveals very strikingly the part that permeability variations play in oil movements through sand. With such knowledge, known circumstances in sand bodies can be met as best possible, to the benefit of an oil-producing operation.

OBSTRUCTION TYPE 4: An area into which water has moved. Oil-wet sand into which water has moved slowly has two distinct characteristics as regards future fluid movements:

1. Very little additional oil can be removed by additional water flowing through such sand.

2. Under field conditions, oil cannot be driven successfully into and through such sand.

Consider the first characteristic. Reasons for this unfavorable situation have been discussed in a previous article.[3] Oil-production curves for five-spots A and D are included in Figure 2 to show how detrimental to oil production encroachment or secondary water in the sand can be. No anomalous permeability conditions exist in five-spots A or B. But driven water had slowly moved over much of five-spot A. Also, water had moved over much of five-spot D and over part of five-spot C. Data on the four five-spots are presented in Table I.

The excellent oil-production experience from five-spot B is characteristic of the experiences elsewhere in that part of the area not "contaminated" by encroaching water. During the first three years more than 14,000 barrels of oil were produced from each of the five-spots adjoining five-spot B to the north, northeast, and east. The unfavorable experience in five-spots A and D is also characteristic of the experiences in the other "contaminated" five-spots of the area.

Huge Loss of Oil

Loss of oil in this manner, now known to be preventable, has been so huge in some fields that Figures 4 and 5 are included to emphasize the nature of the situation. In Figure 4 have been plotted the average oil-saturation values for each of the four five-spots for the first three years of water-drive operation. The ordinate values were determined by subtracting the measured oil production from the quantity of oil in the five-spots at the start of the water-drive operation. The latter is the weighted average of the oil-contents, as measured at each of five tested wells for each five-spot, taking into consideration the size of each five-spot. The total reservoir capacity of each five-spot was similarly determined.

With no permeability anomalies and no secondary water in the sand when the new water drive was started, the ultimate oil saturation in five-spots A, C and D should have been just as low as it will be in five-spot B. It is obvious that, unless some new factor enters, the present oil-saturation difference of 12.5 percent of the pore space will never be reduced. It may be expected to increase slightly. The high residual-oil-saturation values for five-spots A, C and D are the result of oil lost due to the secondary water and the "tight" spot.

The extent of the loss is indicated in Figure 5. Here the quantities of oil represented by the differences in oil-saturation values for the three "troubled" five-spots and five-spot B are plotted against time. The reverse in the early part of the curve for five-spot C is due to the "tight" spot. In that five-spot the effect on oil production of the drive from the north was immediate. The drive from the south, moving through the "tight" sand, was delayed for some months. The irregularities in the curves at about seven months for five-spots A and D reflect the irregularity in the curve in Figure 2 for five-spot B, due to the temporary nature of the early gas drive in that five-spot. As is indicated by Figure 5, the effect of the inability of the new water drive to move oil from the water-soaked sand was felt very quickly and has continued to increase since. The resultant loss was not made up anywhere else. The "lost" oil is still in those five-spots. Until a new method is developed and used to move it, that oil will remain unavailable.

Example of Oil-Wet Sand

In the south-central part of Figure 3 is to be seen an excellent example of the second characteristic of oil-wet sand into which water has moved slowly. Water moved very slowly southeastward from the "leaker" well located near the center of the area. In so doing, it developed an area of water-soaked sand. Later, water from the sources located on the easterly part of the south property line drove oil northward against that water-soaked sand, but not measurably into it. The pressure available at the "leaker" well was very low. That at the sources on the south property line was of the order of 1200 pounds per square inch at the sand face. The very-high-permeability area in the southeast corner greatly facilitated the fluid movement northward, with the results shown. The oil "piled up" against the water-oil mixture in the water-soaked sand. A measured oil saturation of 88.8 percent resulted. This does not mean that the water-soaked sand necessarily withstood a pressure difference of the order of 1200 psi. Here, as in most similar cases, the higher pressure had points of relief (producing wells). It is improbable that the full value of the pressure at the intake wells was effective against the water-soaked sand. The maximum pressure difference that a water-soaked sand can withstand is not known.

Similar conditions have been observed in many places in the Bradford field and at some places in the Bartlesville "shoestring" sands of eastern Kansas. In five-spot water flooding, large volumes of otherwise available oil have been trapped because producing wells have been drilled into water-soaked sand, whereas one or more of the offset intake wells have been drilled into clean pay sand. Under such circumstances, the water drives from those intake wells cannot force oil through the water-soaked sand to the producing well. The oil stays in the sand.

TABLE 1

Effect of "Old" Water and "Tight" Spot on Oil Production

Data from four 5-spots
Locations indicated in Figure 3

5-Spot Designations	A	B	C	D
Area Included in 5-Spot, Acres	2.41	2.33	2.63	2.49
All Permeable Sand, Including "Black" Sand:				
Average net permeable sand thickness, feet	18.35	15.32	16.71	16.64
Weighted average porosity (at five wells in each 5-spot), percent	14.74	14.81	13.39	14.24
Reservoir capacity, barrels	50,600	41,050	45,700	45,800
Weighted average permeability (at five wells in each 5-spot), millidarcies	7.69	9.34	5.49	7.63
Secondary water present at start of new flood	much	none	slight	much
Weighted average oil saturation at start of new flood, percent	52.27	58.59	55.04	51.71
Oil in 5-spot at start of new flood, barrels	26,450	24,050	25,150	23,700
Oil produced during first three years (including shrinkage), barrels	8,200	14,450	8,700	6,800
Oil in sand, end of three years' operation, barrels	18,250	9,600	16,450	16,900
Average oil saturation, end of three years, percent	36.1	23.4	36.0	36.9
Daily average oil production, end of three years, barrels	2.1	2.1	1.5	2.2
"Black" sand layer only:				
Average thickness, feet	1.4	1.3	1.0	1.3
Weighted average oil saturation at start of new flood, percent	49.6	79.1	64.4	68.9
Oil content at start of new flood, barrels	2,700	3,750	2,259	2,900
Water content at start of new flood (connate plus secondary), barrels	2,175	650	1,225	1,125
Weighted average water saturation at start of new flood, percent	40.0	13.7	34.8	26.5

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Suggested reasons for the inability to drive oil through water-soaked sand have not yet been proved factual. But a hypothesis has been developed which may explain the matter. Figure 6 is an enlargement of part of Figure 6 of a previous article.[3] It is a drawing of a highly-magnified thin section of Bradford oil sand. The sand grains are black. The fluid-arrangement pattern is that deduced from observable phenomena for the circumstance of a very slow-moving water drive through oil-wet sand. When pressure is removed, the drive ceases; water ceases to move forward; gas bubbles expand and some gas comes out of solution. A fluid rearrangement occurs within the capillaries. The long, thread-like columns of water within some of the capillaries break up into water droplets scattered through the oil, a condition greatly exaggerated by the predominantly thin, flat shapes of Bradford sand pores. That seems to be the state of affairs in water-soaked sand. It is illustrated in Figure 7.

New Water Drive

If a new water drive is started in the water-soaked, oil-wet sand, gas bubbles are again compressed; again some gas goes into solution; new columns of water start forward. Usually, that water again connects the separated water droplets into continuous threads and the drive proceeds. But little or no oil is driven from that water-soaked sand, although some may be removed by solution in the new driving water. When the newly-moving water drive moves into clean sand, oil removal proceeds normally.

However, if the new water drive starts in high-oil-content sand with no old driving water present, a normal oil bank develops ahead of the new water. If that oil bank (oil concentration) is driven against a water-soaked area such as is represented in Figure 7, the gas volume in that water-soaked sand decreases. The water droplets start to move forward. But the new water is separated from the droplets by "solid" oil. Having no new water supply available, the droplets do not join. Because of interfacial forces, the water droplets surrounded by oil have difficulty in moving through constrictions in the pores. Therefore, they form plugs, around which the oil (more viscous than the water) moves very slowly or not at all. Finally, a series of plugs forms which stops further movement of oil into the water-soaked sand.

A similar condition appears to develop when air is pumped under high pressure into a water-intake well. In a Denwood property in the Bradford field, a large volume of water was being circulated uselessly through "open" watered-out sand. As an experimental project, air at 500 psi was forced into some intake wells for a few days. Water was then again turned in. For a period of about a month following the air treatment, the quantity of water uselessly circulated was greatly reduced, with no loss in oil production. Following that period, the rate at which the water circulated gradually returned to the pre-treatment value. The treatment was repeated with similar results. Apparently, tiny air bubbles became distributed in the water in the pores of the watered-out sand, effectively plugging many of them. However, as the air gradually dissolved in the water, the effectiveness of the "plugs" so formed gradually decreased and ultimately disappeared.

It has not been proved that the hypothesis is correct. But it seems reasonable and does no violence to factual observations, to the known characteristics of the sand and fluids nor to physics. The results agree with known facts. The problem remains of what to do about it.

Avoidance Proves Successful

One successful procedure has been that of avoidance in five-spot water flooding. Trained observers in core testing have learned to identify water-soaked sand. In a development such as that on the Coit property (Figures 1 and 3), pressure intake wells are drilled first and all sand is tested. All water-soaked sand areas are identified, layer by layer, and can be contoured on the map. Only then are producing-well locations determined. If there are no permeability anomalies, no water-soaked sand conditions and no discontinuities in important sand layers, the location for the producing well is placed in the geometric center of the five-spot. But if any or all of these conditions are present in a five-spot, the best compromise location for the producing well is determined. On very rare occasions two producing wells in the five-spot are warranted. Notice the location of the tested producing well southeastward of the "leaker" source of water near the center of the property. That producing well is located southeastward of the center of the five-spot to avoid as much water-soaked sand as possible. Similarly, producing wells in the north row of five-spots and in some other five-spots in the property have been located, not in the centers of their five-spots, but where they will avoid best the trapping of oil so far as possible. They are located where they can provide the most oil. This procedure has been successfully practiced for some years[6] to the substantial benefit of oil production. That is avoidance.

No cure for the condition represented in Figure 7 has been proved in the field. Some means of removing the water droplets would seem to be required. A suggestion as to how this might be accomplished has been made.[3]

Movement of Fluids

In some sands, fluids can move freely across the bedding. In such sand, where an obstruction occurs in only a part of the sand thickness, the fluids may move over or under the obstruction. To what extent they return to their original elevation will depend on permeability conditions beyond the obstruction. The Bradford Second sand is similar to the Third sand in that it is oil-wet. But it is different in that it contains no mica and hence no flow-controlling mica beds. In one Bradford Second sand area the principal part of the sand body is about 25 feet thick, with no known interbedding of any sort, but with erratic permeability variations throughout. From an unpublished study made by Donald T. May, based on test data at many wells and on production experience, it is apparent that per-

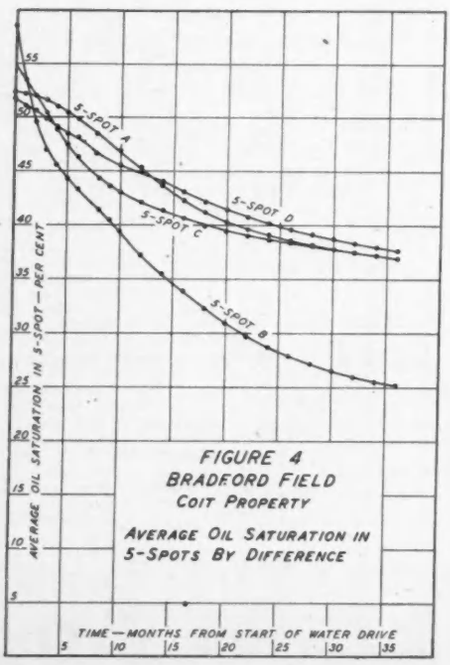


FIGURE 4
BRADFORD FIELD
COIT PROPERTY
AVERAGE OIL SATURATION IN 5-SPOTS BY DIFFERENCE

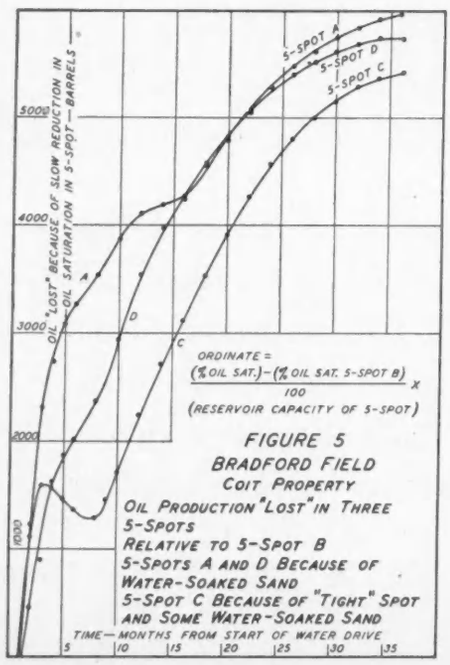
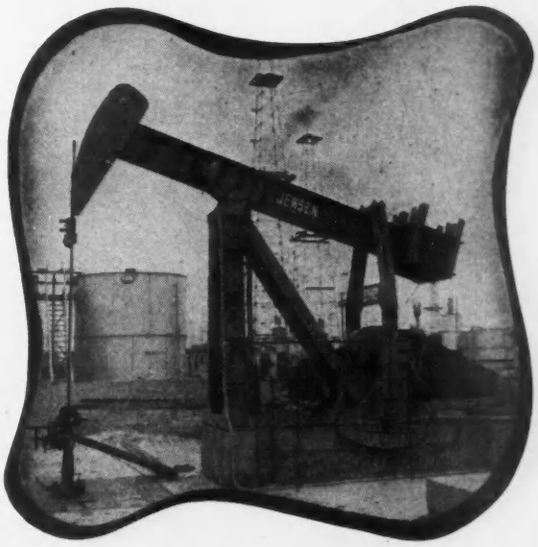

5-SPOT A
5-SPOT D
5-SPOT C
OIL "LOST" BECAUSE OF SLOW REDUCTION IN OIL SATURATION IN 5-SPOT — BARRELS
ORDINATE = (% OIL SAT.) − (% OIL SAT. 5-SPOT B) / 100 × (RESERVOIR CAPACITY OF 5-SPOT)
TIME — MONTHS FROM START OF WATER DRIVE

FIGURE 5
BRADFORD FIELD
COIT PROPERTY
OIL PRODUCTION "LOST" IN THREE 5-SPOTS RELATIVE TO 5-SPOT B
5-SPOTS A AND D BECAUSE OF WATER-SOAKED SAND
5-SPOT C BECAUSE OF "TIGHT" SPOT AND SOME WATER-SOAKED SAND

The Pot is Boiling in Coffeyville—



We're busy as can be. Instead of mass producing quality pumping units, however, we're busy on the phone chasing steel, bearings and other materials. The little steel we do have is being built into pumping units. But these few don't even come close to filling your needs.

No one can be more disappointed than we are in the crimp this steel shortage puts in our production schedule. So if you're "huntin' " for pumping units, just remember we're "huntin' " for steel and that we're keeping the pot boiling doing everything we can to help you. Even if it does take time, you'll be glad you waited for a Jensen.

JENSEN

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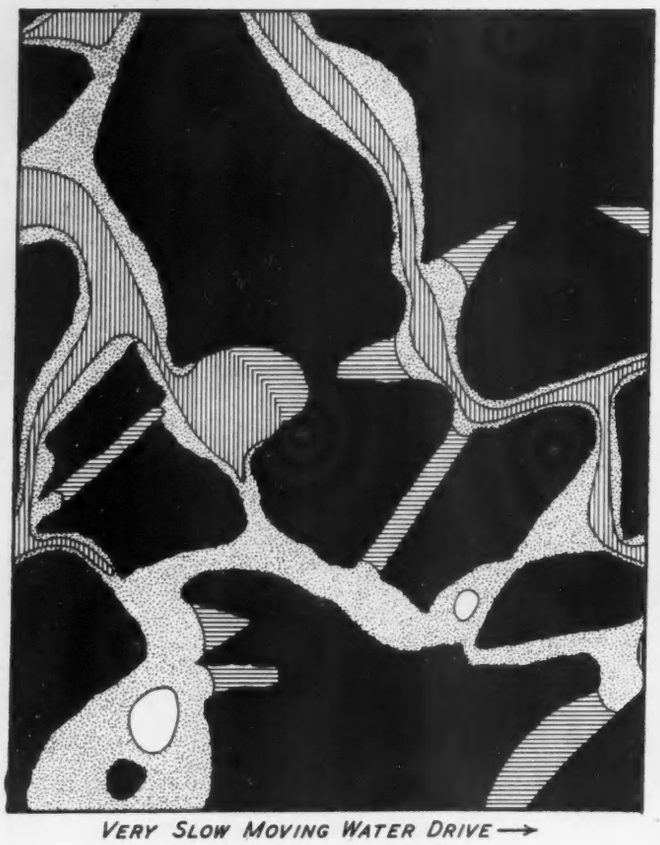


VERY SLOW MOVING WATER DRIVE →

SOLIDS
CONNATE WATER
DRIVE WATER
OIL
GAS

FIGURE 6

ENLARGEMENT OF PART OF FIGURE 6 OF REFERENCE 3

OIL-WET SAND

DRIVING WATER FORMS CONTINUOUS "THEADS"

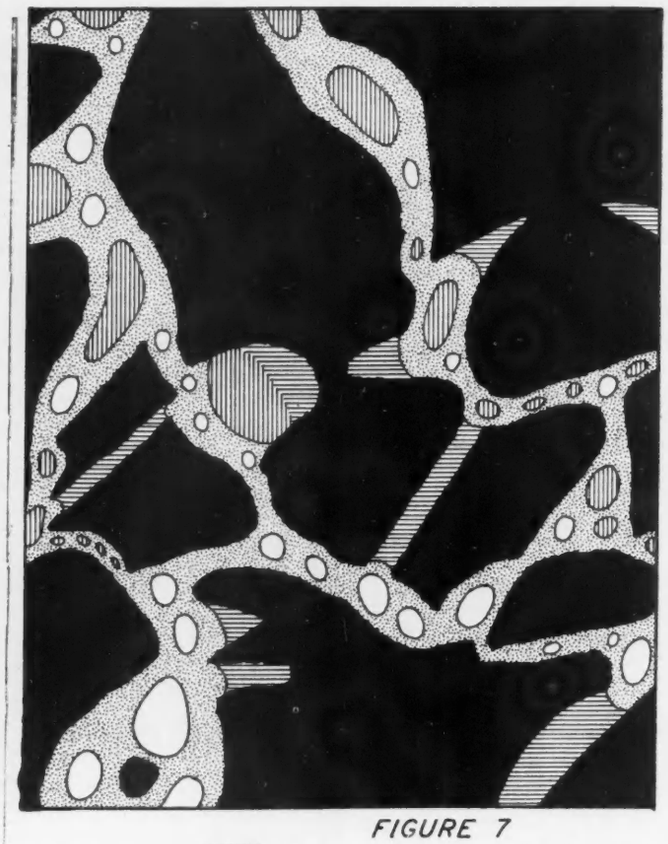


FIGURE 7

SOLIDS
CONNATE WATER
DRIVE WATER
OIL
GAS

SAME AS FIGURE 6, EXCEPT THAT WATER-DRIVE HAS CEASED, PRESSURE HAS DISAPPEARED, GAS HAS EXPANDED AND FLUID REARRANGEMENT HAS OCCURRED.

DRIVING WATER HAS SEPARATED INTO DROPLETS

meability irregularities have been responsible for oil and water at places moving with vertical components. In this manner the water drive appears to have bypassed important volumes of sand containing valuable quantities of oil. No treatment is known at present for this unfavorable condition.

Crevices and open beds are sometimes present in oil sand. Occasionally they are identified in cores. Usually their presence is made known only through operating experience. They do not constitute obstructions, but they have been known to interfere with the effective removal of oil from nearby sand. The least trouble they cause is the useless and sometimes costly handling of water from the producing wells and, in the case of water flooding, into the intake wells. In some water-flood operations, the operator has restricted the quantity of water supplied to intake wells in an effort to limit the handling of water moving through crevices or open beds. In this manner, he incidentally reduces the sand-face pressure. A result is too-slow driving in the pay sand with a consequent delay and loss in oil production. The treatment is to eliminate the bad formation from exposure to pressure. At places this can be done by the judicious placing of packers. More often, the crevice or open bed is plugged with materials especially developed for the purpose. Successful plugging is a sepecialty operation and requires experienced manipulation.

At some locations, beds of high-permeability sand containing little oil present a problem similar to that of crevices. See Figure 6 of reference 5. This trouble is aggravated by the high realtive permeability to water of low-oil-content sand. Sand of this character is readily identified through testing. The treatment is similar to that for crevices except that a different class of plugging material must be used and a different technique employed. As great care must be exercised to avoid the plugging of pay sand, this, too, is a specialty operation. Recently, the selective plugging procedure has been successfully extended to include high-permeability watered-out sand that was one-time pay.[8]

General Technical Considerations

Always, the object of an oil-production operation is to produce the most oil, consistent with sound economic considerations, from a given property. To accomplish this objective, the detailed mode of operation must be fitted to the specific physical nature of the oil sand and its contents. Some of the technical conditions which may profoundly affect the quantity of oil produced:

1. Quantity of oil in the sand.
2. Quantity of true connate water in the sand.
3. Quantity of encroached or meteoric water in the sand.
4. Porosity and permeability of the sand.
5. Areal and stratigraphic variations in porosity and permeability.
6. Characteristic pore shapes.
7. Nature of pore surfaces, i.e., preferentially oil-wet or water-wet.
8. Absolute pressure in the sand, or to be created in the sand, whether natural or artificial.
9. Quantity and nature (gas or water) of the driving fluid available.

From the above can be determined:

1. The distribution and arrangement of the various fluids, areally, stratigraphically and within the pores.
2. The effective permeability of the various parts of the formation.
3. The optimum drive velocity and the quantity of driving fluid necessary.
4. The pressure necessary for optimum drive velocity.
5. Well locations for the most effec-

tive oil removal (for which economic considerations must be included).

6. Individual well treatment (shooting, acidizing, etc.) necessary to accomplish the desired objectives.

7. The driving medium.

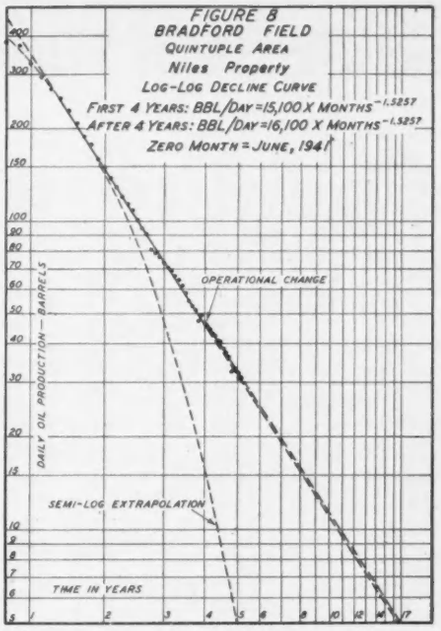
All of this means that to obtain the most oil from a given property at minimum cost and within economic time limits, it is necessary for the operator (or his engineers) to have an intimate knowledge of the materials with which he is working: the sand and its contents. Further, he must have a practical working knowledge of the reactions of these materials to the various forces which can be applied; a knowledge of cause and effect as to fluid movements within the specific reservoir. Only by the application of such knowledge can continued improvement be expected in the effectiveness of oil-production operations. Today this type of approach to technical planning and operation is common in all progressive technical activities. It has proved practical and valuable to the oil-production industry.

Strategic Drilling

To obtain a really satisfactory understanding of the nature of a particular reservoir, extensive drilling, with all wells completely tested, would be necessary. But in many cases, extensive drilling is economically neither feasible nor warranted. In such cases, strategic drilling is usually practicable. Properly planned (for information first and production later) and with full advantage taken of the information made available, such drilling can be highly profitable. In any situation, the competent testing of all new wells is essential. So is the competent study of the information obtained from such testing.

It is true that information obtained from a well test provides a precise measure of conditions only at the time and location of that test. But this is true of most testing. The competent engineer obtains the information absolutely essential and takes all the information available. He then projects his facts to cover the area of interest concerned. Because complete information is always lacking, he does not expect to do a perfect job, whether he be working in the field of oil production, transportation or electronics. But the results of his work are a vast improvement over those achieved by lesser methods.

In the field of oil-producing operations, starting with competent well-test data, the engineer greatly expands his knowledge of the reservoir with the aid of performance data, both past and current. All producing wells tend to follow a definite mathematical pattern. With rare exceptions, if operating conditions are reasonably constant, the daily oil-production rate follows the form[7]



$$P = A\,t^{b}$$

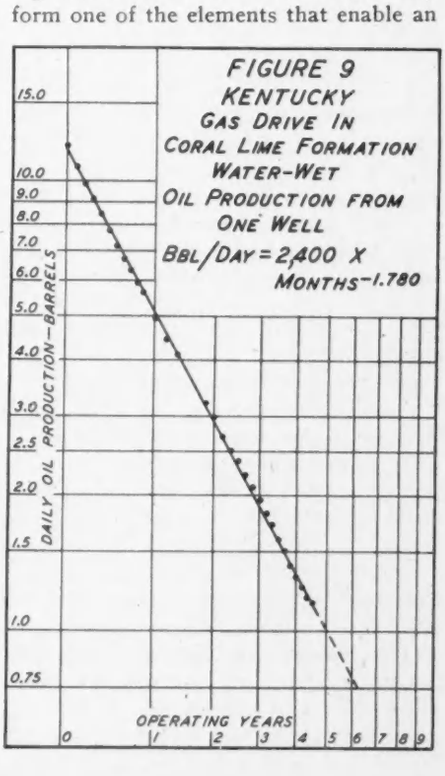
where

P = oil-production rate in barrels per day

t = time in months from some empirical zero

A and b = constants peculiar to the local circumstances.

This information produces a straight line when properly plotted on log-log paper, as illustrated in Figure 8 (a production curve for a high-pressure waterflood operation in oil-wet Bradford sand) and in Figure 9 (a production curve for a gas drive in water-wet coral lime). The values of the constants A (the position of the curve) and b (the slope of the curve) are important to an understanding of the reservoir characteristics. They form one of the elements that enable an



engineer to comprehend the nature of the reservoir and its contents and also of the nature of variations in them between test wells.

Effect of Change in Mode of Operation

The effect on oil production of any change in the mode of operation, intentional or otherwise, is reflected immediately in the curve by a change of position or slope or both. Because of this, the engineer is able to determine and evaluate the effect of such change on future oil production. With collateral information, he can usually lead to the cause of such change. If the result of a change is favorable, it may thus be possible to advantageously expand the change or to introduce it elsewhere.[8] If the result is unfavorable, the necessary corrective measure can usually be determined. Thus, through knowledge, improvement in oil production is effected.

Further improvement in the effectiveness of oil recovery from most reservoirs is practicable. Improvement is most likely to be a result of the better adjustment of operational methods to the requirements of the specific reservoir. Revolutionary improvements are possible but do not appear to be imminent. Detail refinements in many places are not only possible but many are highly practicable. In the aggregate, they can be of great advantage to oil producers and to an oil-hungry world.

ACKNOWLEDGEMENTS

Kendall Refining Company provided special facilities and personnel for the periodic accurate gauging of all producing wells in the Colt property. From the data so obtained, Ryder Scott Company prepared all individual production records of both oil and water. These records were prepared in both tabular and graphic form. In addition to this extensive work, all of the sand from 74 wells was tested and the resulting data analyzed. All of the wells were drilled within the approximately 54 acres included in the contoured portion of Figure 1. The Golden and Smith Oil Company provided similar accurate information from their Niles property.

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Chromated Protein Films Inhibit *Corrosion*

CHROMATED protein coatings* offering a convenient, inexpensive means of protecting metals — especially zinc, iron, brass, and aluminum—during outdoor storage in mildly corrosive atmospheres have been developed by Abner Brenner, Grace Riddell, and Robert Seegmiller of the National Bureau of Standards, as described in Technical Report 1208 of the bureau. The protective value of such films is somewhat better than that afforded by chemical surface treatments and is much superior to that of corrosion-inhibited oils and waxes. The metallic surface to be coated is first dipped in casein, albumin, or gelatin; the resultant film is then impregnated with chromate, which both hardens the film and inhibits corrosion. The wartime scarcity of many nonferrous metals led to the extensive substitution of ordinary carbon steel for copper, brass, aluminum, and stainless steel in both military and civilian uses. While the steel was generally protected with zinc coatings, the tendency of the zinc to form objectionable corrosion products brought about a widespread use of chromate films on the zinc. These films were formed on the surface by chemical attack in aqueous chromate solutions and, though only a few hundred-thousandths of an inch thick, were useful in inhibiting corrosion. However, as this apparently was due to the presence of minute amounts of soluble chromate, slowly liberated by the action of moisture, it seemed possible that an enhanced corrosion resistance might be obtained by applying a large quantity of chromate to the metal surface. The National Bureau of Standards therefore undertook an investigation in which proteins were found to offer a good medium for increasing the amount of chromate on the metal surface since they are basic and readily absorb or combine with chromic acid. Although initially developed at the bureau as a substitute for chemical surface treatments of zinc, the chromated proteins are also of value in protecting aluminum, steel, brass, and other metals.

The principal constituents of the chromated protein films are a corrosion inhibitor for the metal, a protein which acts as a vehicle for the inhibitor, a hardening agent, and a bactericide to prevent putrefaction of the protein. The chromate always serves as the inhibitor and may act as the hardening agent and the bactericide as well. However, other materials such as formaldehyde, tannins, or certain salts of the heavy metals can be used as the hardening agent.

The four functioning constituents of the film can be applied in a single step or in several steps, according to the compatability of the agents and the degree of protection desired. In the "two-step" process, which is usually the most satisfactory, the metal is first dipped into an aqueous protein solution. When the resulting protein film is dry, it is immersed in an acidified chromate solution for from one-half to three minutes and allowed to dry without rinsing. The preparation of the protein solution varies somewhat with each protein. Gelatin is dissolved in water by heating gently; albumin may be dissolved in water at room temperature by stirring; casein is dispersed in water and brought into solution with the addition of 25 ml of ammonium hydroxide per liter of solution. The chromate solution contains chromic acid (0.5 to 2 percent) or a dichromate of zinc, iron, or nickel (1 to 10 percent).

A simpler "one-step" method of forming the inhibiting film by a single immersion in a solution containing both the protein and the chromate has the disadvantage that the solution slowly deteriorates. A solution of this type is made by adding ammoniacal zinc chromate to a solution of casein. The resulting preparation should contain about 10 percent of casein and the equivalent of about 5 percent of zinc chromate.

The chromated protein films are yellow and, unless opaque pigments have been added, are transparent. Their flexibility and adhesion are sufficient to prevent cracking or separation when the metal is bent. They are not injured by heating to 150° C., whereas most chromate films produced chemically on zinc lose much of their protective value at 100° C. Thickness depends principally on the concentration and viscosity of the protein solutions, varying with the type of protein up to about 0.0002 inch. This is in contrast to the proprietary chromate films, which usually are not more than 0.00003 inch thick.

When freshly prepared and hardened, the films are almost insoluble in water and so hard that they cannot be scratched with the finger nail. Exposure to light further hardens some films and renders them still less soluble. However, the films may be quickly removed from metal parts by application of an alkaline solution such as 5-percent sodium hydroxide. Their removal is thus more convenient and less hazardous than the removal of oil films with toxic or inflammable organic solvents.

The protein solutions, unlike the baths used for direct phosphate or chromate treatments, do not become exhausted and require replenishment, but are fairly stable for long periods. While chromated protein films are superior to direct phosphate or chromate coatings or to oil films for corrosion prevention, their life is less than that of suitable paint coatings. They are more effective on large, regular surfaces than on the sharp edges and corners of small objects like nuts and bolts, where the film tends to pull away.

Editor's Note:

Chromate films, whether of the commercial (proprietary) type or obtained by the protein methods described above, cannot be regarded as providing other than temporary protection. They find their greatest applicability in the safeguarding of materials during shipping and/or storage prior to being placed into service.

Where the protective coating must be stripped in quarters where ventilation is restricted, or where operators might be exposed to the fumes of whatever solvent is applied, the chromates offer the advantage of being soluble in sodium hydroxide solutions of relatively low strength. Thus dermatitis and attendant skin disturbances are minimized, as well as is the hazard from fire.

When used on interior surfaces, flushing out with the alkaline solution followed by a clear water rinse and adequate drying, leaves the protected surface clean and ready for use without further contaminating any fluids with which it may come in contact.

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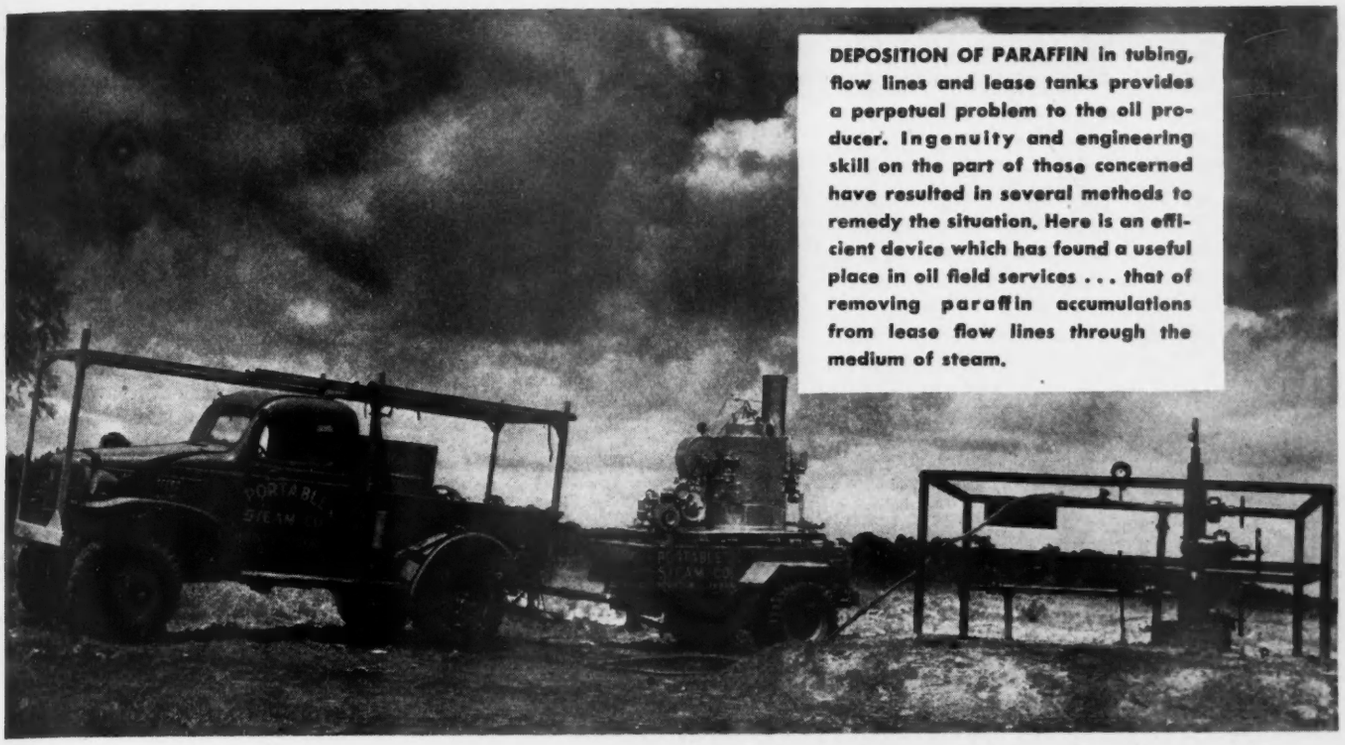
* For further technical details see "Chromated protein films for the protection of metals," by Abner Brenner, Grace Riddell, and Robert Seegmiller, in J. Electrochem. Soc. for March, 1948.



DEPOSITION OF PARAFFIN in tubing, flow lines and lease tanks provides a perpetual problem to the oil producer. Ingenuity and engineering skill on the part of those concerned have resulted in several methods to remedy the situation. Here is an efficient device which has found a useful place in oil field services . . . that of removing paraffin accumulations from lease flow lines through the medium of steam.

Portable steam generator and truck on location at the well site. Steam exhaust is connected into the flow line at the well head through a flexible metal hose.

Steaming Flow Lines to Remove *Paraffin*

ADAPTATION of an efficient, lightweight, portable steam generator has brought about an effective and inexpensive solution to one of the lingering problems in producing oil wells. Deposition of paraffin or petroleum waxes in the well tubing, flow lines and other lease equipment is ever-present in varying degrees in fields which produce a paraffin-base crude. Since the melting point of paraffins found in petroleum range from about 118° F. up to 150° F., deposition of these substances can be expected when the temperature of the crude drops below those values. Except under unusual conditions, surface temperatures are generally below the melting point of paraffin, thereby giving rise to its accumulation, the amount and rate of which are dependent upon the temperature and the paraffin content of the oil. In many fields this problem is acute, involving an expensive program of paraffin removal in order to handle peak oil production. In other fields, paraffin is less serious, requiring only occasional cleaning of the well and least equipment.

The use of steam in removing paraffin from lease flow lines is not new. However, until recently, to perform such an operation safely required bulky equipment which involved considerable expense. Other methods have been used. Solvents have been introduced into the annulus between the casing and tubing, or into the wellhead, in an effort to keep the paraffin in solution. Hydraulic equipment is available to pump soluble plugs through the flow line and thereby forcing the paraffin out of the line. Recirculation of heated oil has also been tried with varying degrees of success.

General Description

The portable steam generator weighs only 1350 pounds and is easily mounted on a two-wheeled trailer. The unit illustrated is rated at 40 horsepower and is of the forced circulation, continuous water coil type. It is equipped with forced draft blower, water feed pump, fuel pump, steam temperature limit control, fuel flow control, water bypass control, and two safety "pop" valves. The unit is capable of generating steam at the rate of 1250 pounds per hour while consuming about ten gallons of kerosine per hour.

Depending upon the requirements of a particular job, the generator provides a continuous flow of steam at pressures ranging from a maximum of 600 pounds per square inch down to about 75 pounds per square inch. A distinct advantage of this unit in cleaning flow lines of paraffin is its ability to reach maximum steam pressure almost instantly after firing. Operation of the steamer depends upon a continuous supply of water and fuel. The unit automatically shuts off when either is exhausted and remains inoperative until flow is resumed. Steam pressures and temperatures are also limited by automatic controls which stop the generator when either reach selected maximum set-

tings. Water is pumped into a staggered coil assembly which surrounds the combustion chamber. Fuel is atomized by a high-pressure spray head and ignited by two electrodes in the fire pot located directly above the combustion chamber. A magneto ignition system provides a continuous low-frequency arc across the electrodes.

Water and Fuel Supply

A flat steel tank 14 inches deep is mounted on the trailer frame below the steam generator to provide storage for both water and fuel. A forward compartment in the tank has a capacity for 30 gallons of fuel which is sufficient to fire the boiler for three hours. The rear compartment holds 250 gallons of water, which under normal conditions will last for about two hours operation. The trailer is towed to location by a three-quarter-ton four-wheel drive truck which carries auxiliary equipment and additional supplies of fuel and water.

After the well is closed in and the pressure on the flow line is bled off, a swedge nipple is screwed into the flow line tee at the well head as shown. To the swedge is connected a check valve to prevent back flow in case the generator should automatically shut off momentarily. A long flexible one-inch bronze hose connects the generator steam exhaust to the well flow line. The pumper then switches the flow line stream from the separator or gun barrel tank into the burning pit or slop tank which receives the molten paraffin, waste oil and hot water. The generator is then fired, but allowed to exhaust water and steam into the atmosphere until a steady flow of superheated (450° F.) steam is produced. The well is again opened and steam injected into the flow line at the desired pressure. The superheated steam heats the oil which flows continuously through the line, and thereby melts the accumulated paraffin. The steady flow of heated oil prevents clogging up the flow line in severe cases of paraffin deposits.

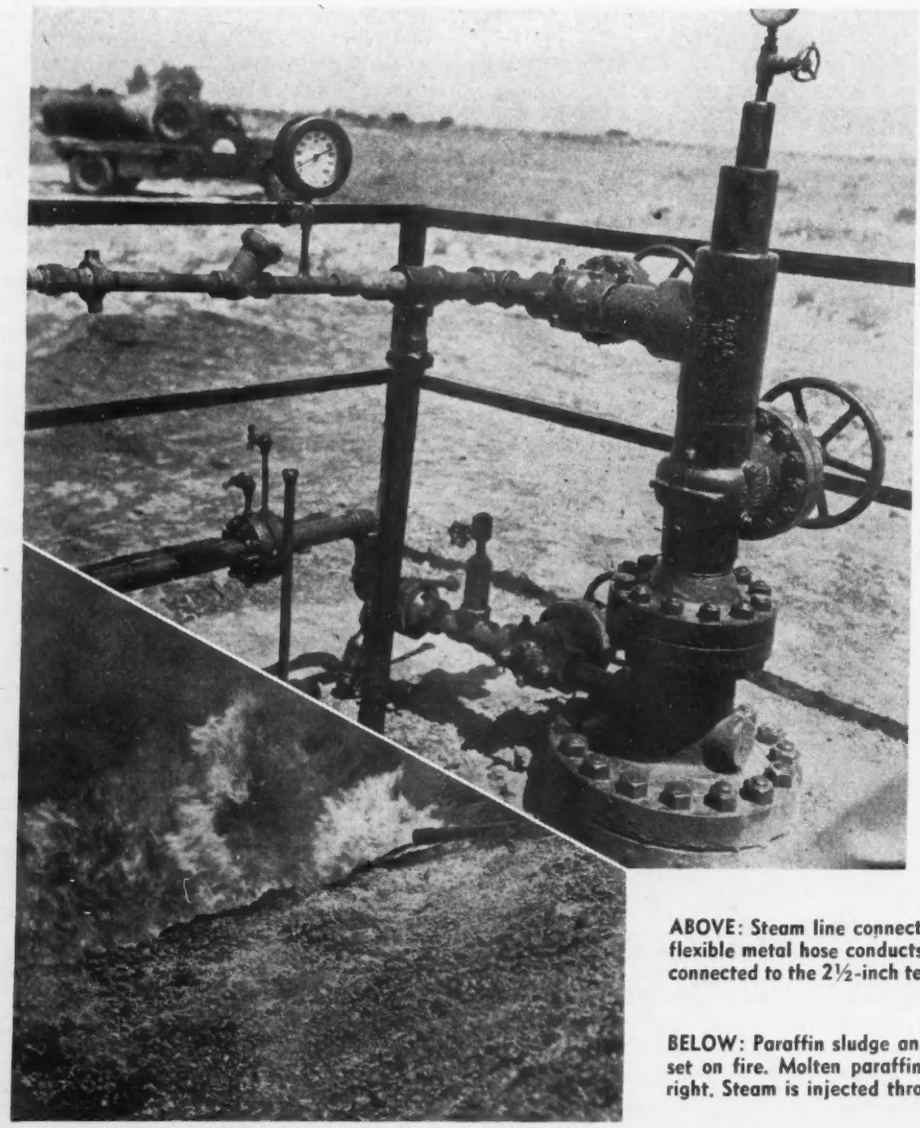
Once the sludge reaches the pit it is set afire and continues burning during the steaming process. Effectiveness of the method can readily be determined by feeling the separator manifold where the mixture is diverted into the burning pit. One of the necessary precautions in this type cleaning operation is that of careful observation of the flow line. Considerable expansion of the line can be expected at the temperatures reached during the heating process. If the line is relatively long and contains several bends, the danger of breaking a flow line through expansion due to heat is negligible. Where the line is laid on the surface it can be observed for excess expansion, and if necessary, it can be disconnected at some convenient point to overcome any strains imposed upon the line.

When there is no evidence of paraffin being discharged into the pit, the generator is stopped and the flow of oil diverted back into the separator. If it is not desired to burn the sludge, a slop tank is used and the mixture allowed to flow into it until the line is cleaned. Some oil can later be treated and made into pipe line oil.

Cost of removing paraffin with this type steam generator varies according to the amount of deposition in the flow line. Average cost over several hundred jobs indicates that half a mile of 2½-inch flow line can be cleaned for a cost of approximately $18.

As much as one mile of 2½-inch flow line can be cleaned of paraffin at one time. If the line is considerably longer than one mile, it may be disconnected about every quarter of a mile after the upstream section has been cleaned and the generator moved up to a new position on the line. This process is repeated until the line is free of paraffin. The unit is then shut down and the steam line disconnected from the flow line, after which the well is again turned into the separator or gun barrel.

In addition to the application described above, the portable steam unit has other uses in the oil fields. It may be used to "roll" or churn up lease stock tanks while at the same time heating the contents so the tank may be easily cleaned. Heating and churning tanks in this manner makes the contents less viscous and they may be drained into the burning pit. This cleaning process is much more desirable than opening the manhole plates and actually shovelling the sediments from the tank. It also provides a quick means of heating and treating crude oil. These are but a few useful adaptions of this modern steam generators that reduces on-the-job time where steam is required.



ABOVE: Steam line connections into the flow line at the well head. One-inch flexible metal hose conducts steam into the flow line through a swedge nipple connected to the 2½-inch tee. Back-flow is prevented by the check valve shown.

BELOW: Paraffin sludge and hot water are diverted into the burning pit and set on fire. Molten paraffin may be seen flowing from the 2½-inch line at right. Steam is injected through the line until all paraffin has been removed.

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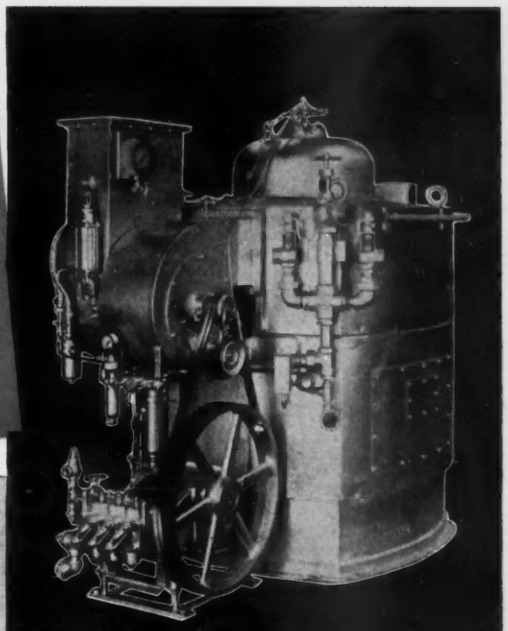

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40 HORSEPOWER

Water Evaporated to Steam, per Hour—1250 lbs. Maximum Fuel Consumption, per Hour—9 gallons. B.T.U. Output, per Hour—1,250,000. Maximum Working Pressure—600 p.s.i. Length, 69⅜"; Width, 34½"; Height, 47". Net Weight, 1350 lbs.

80 HORSEPOWER

Water Evaporated to Steam, per Hour—2750 lbs. Maximum Fuel Consumption, per Hour—24 gallons. B.T.U. Output, per Hour—3,000,000. Maximum Working Pressure—600 p.s.i. Length, 80"; Width, 61"; Height, 77". Net Weight, 3700 lbs. (dry).

100 HORSEPOWER

Water Evaporated to Steam, per Hour—3500 lbs. Maximum Fuel Consumption, per Hour—32 gallons. B.T.U. Output, per Hour—3,750,000. Maximum Working Pressure—600 p.s.i. Length, 80"; Width, 61"; Height, 77". Net Weight, 3800 lbs. (dry).

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Mud Acid Increases Production in Tuscaloosa Sands

By L. C. POWER, JR.
Dowell Incorporated

IN THE oil and gas fields of central Mississippi the sands of the Tuscaloosa group are important producers of petroleum. The depths of the producing zones in the Tuscaloosa vary from 6000 to 11,000 feet. The sands are fairly persistent and are generally present in all the fields, the more important of which are shown on the map (Figure 1).

The Tuscaloosa sands exhibit generally high porosities, in some instances as much as 29 percent, and a wide range of permeabilities. The average permeability, however, is low. The low permeability of the producing formations may be further reduced by mud or drilling water infiltration during drilling of the wells. Because of this and the presence of certain clay minerals in some of the sands the use of mud acid has become a practice for improving the wells in most of the fields.

Properties of Mud Acid

Mud acid is a mixture of hydrochloric acid and various addition agents that provide it with the ability to dissolve certain clay minerals such as mantmorillonite, beidellite, illite and kaolin. Another desirable property of mud acid is that in cases where an excess of bentonitic material is encountered in a formation and the available acid will dissolve only a part of it, the mud acid will destroy the swelling properties of the entire mass. Bentonite or gel that has been treated with mud acid will have a high permeability to water, even though only a small part of the mass has been dissolved in the acid. Bentonite which has not been acidized will have a much lower water permeability.

Most drilling muds contain large percentages of clays, some of which possess high colloidal properties, such as the relatively pure bentonites. The clays usually found in drilling muds are montmorillonite, beidellite, illite, and kaolin. It also has been long known that many of the oil producing sands of the Gulf Coast, including those of the Tuscaloosa group, contain appreciable quantities of these clay minerals, with the percentage ranging from 0 to 50 percent of the formation by weight.

The rotary drilling fluids normally employed in drilling the Tuscaloosa sands are composed of native clay and varying quantities of gel and other mud conditioning agents such as soda ash, tannic acid, and barites. In some cases where special problems are presented, starch-carrying muds are used. The pH of the average mud will be 9.3, the average filter loss 9 cubic centimeters and the average thickness of the filter cake 3/32-inch. The mud acid solubility of a typical drilling mud used in drilling the Tuscaloosa will range from 31 to 56 percent, depending upon the composition and percent of total solids comprising the mixture.

Present laboratory data indicate that one gallon of mud acid will dissolve approximately 0.3 pounds of clays such as those mentioned above. The rate of reaction is not affected by pressure. Temperature, however, does have a very considerable effect on the chemical reaction. For example, an increase from 70° F. to 200° F. will cause a 48 percent increase in the rate of reaction of the mud acid upon clays such as are used in drilling muds or are found normally in Gulf Coast sands.

Mud acid acts in two ways to increase the productivity of wells, both of which involve the chemical solution of silt and clay. First, the productivity of a well may be reduced by the swelling of the various clay-like compounds in the critical zone. Dissolution of this material by mud acid removes the cause of the low productivity of the well. Second, where a high pressure drop in the sand near the well bore is caused by mechanical equipment or methods, the removal, by solution, of the clays and silts from the sand in the critical zone causes an increase in permeability of the sand of this zone of sufficient magnitude to compensate for the low productivity due to the completion method.

Treating Techniques

In many areas acid treatments are made in the conventional manner, using the method described in U. S. Patent number 1,891,667. This involves filling the well with fluid, following which the chemicals are pumped down the tubing while bleeding off sufficient fluid at the casing head to place the chemicals in the desired place in the well. As soon as this is done the bleed-off valves are closed and the balance of the chemicals and the flushing fluid are pumped into the tubing. The flushing fluid is only used to displace the acid from the tubing and is not squeezed into the sand.

Due to the generally low permeability of the Tuscaloosa formation, relatively high pressures are required to force the acid into the sand. Due to this fact most operators prefer to treat the wells under packers or retrievable retainers unless information on treating pressures is known. The use of the packer provides an added safety factor for the casing. On newly completed wells the tubing packer assembly is run into the well but the packer usually is not set until the acid is circulated to the bottom of the well. After the packer is set the acid is squeezed into the formation by following it with enough oil to displace the acid from the tubing.

In those instances where the rig has been moved off, the treatments generally are made under a production packer. This requires that the fluid in the tubing must be squeezed into the formation ahead of the acid, a tedious procedure in cases where high pressures are required. Also, care must be taken in order to avoid unseating the packer if it has not been properly loaded. Here it is prefer-

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FIGURE 1

able to have the tubing placed in the well so that the lower end is opposite the section to be treated.

The volume of chemicals used in making treatments will vary depending upon the type of well and length of the completion interval. The experience gained from acidizing the Tuscaloosa sands indicate that a minimum of 50 gallons per foot of producing interval should be used on those producing wells where it is desired to increase the permeability of the sand. The length of producing interval will vary but the average length of the setcion treated is 24 feet.

The pump pressures required to squeeze the acid into the formation will vary greatly but the average maximum pressure has been 2900 pounds per square inch on the wells treated to date. In most cases there is a definite reduction in the pumping pressure as the treatment progresses. However, this pressure drop as a rule is not obvious as pump speeds are increased to offset it. In those instances where constant pump rates have been maintained, the final average pump pressure was 1700 psi.

The equipment used in making acidizing treatments is a factor that requires consideration. In the main, the pumps used to displace the chemicals into the formations must be adequate to overcome the pressures encountered and must deliver the chemicals to the formation at an optimum rate in keeping with sound engineering thought. The triplex pumps generally used in treating the Tuscaloosa are of 3 sizes, all driven by the 450 cubic inch displacement truck engine. The pumps here referred to are 4½x8 inches, 3¾x8 inches, and 3¾x5 inches. The gear ratio will vary somewhat so that some units will operate under pressures as great as 8000 psi, but at relatively low volumes, while others will deliver as much as 250 gallons per minute at pressures generally not exceeding 1000 psi. All of these pumping units are specially designed and are mounted on heavy duty tandem-bogie trucks built for rugged oil field service. One of these pumping units is shown on the first page of this article.

The use of mud acid for the improvement of injection wells, particularly those utilized for gas input, has been especially beneficial. The primary object in acidizing this type of well is to effect a substantial reduction of the input pressure or to increase the input capacity at constant pressure. Several mud acid treatments have been made on injection wells completed in the Tuscaloosa where injection rates have been increased as much as 300 percent without a noticeable rise of the compressor pressure.

The effect of the mud acid on the input horizon can be two-fold. In recently completed wells the result of an acid treatment may be the disintegration of a filter cake and the increase of the permeability of the formation immediately surrounding the bore hole. Where wells have been utilized for injection purposes for some period and where decreased input rates or rising compressor pressures are observed the use of mud acid can be highly beneficial. This is usually explained by the removal of various scale-like deposits or extraneous material which has filtered out on the face of the input horizon.

In water disposal wells the causes of the reductions in capacity or increased input pressures may differ. The chemical composition of the disposal fluid is one of the important controlling factors. The equilibrium of the salts in solution may be altered due to libreation of gas, changes in temperature, and pressure. Chemical reactions between the water and the well equipment may cause further change in the composition of the input fluid. The presence of suspended matter in the fluid is also an important factor. The presence of one or a combination of any of these factors may result in a definite decrease in the permeability of the disposal formation that can only result in decreased input capacity or elevated disposal pressures.

Treatment Results

All fields producing oil from the Tuscaloosa in Mississippi include wells which have been given mud acid treatments. In most cases these treatments have been very successful as Table 1 indicates.

TABLE 1

FIELD	Depth	Acid Used (Gallons)	Initial Production (B.P.D.)	Result (B.P.D.)
Brookhaven	10,320-34	1000	100	438
Baxterville	8742-8810	1500	No Test	211
Brookhaven	10,244-92	1500	135	327
Brookhaven	10,134-86	1000	No Test	400
Baxterville	8,715-28	2500	No Test	160
Mallalieu	10,458-88	1000	150	240
Brookhaven	10,420-68	1000	0	75
Cranfield	10,205-75	1000	Input Well—No improvement	
Brookhaven	10,420-465	1000	90 Swab	90 Flow

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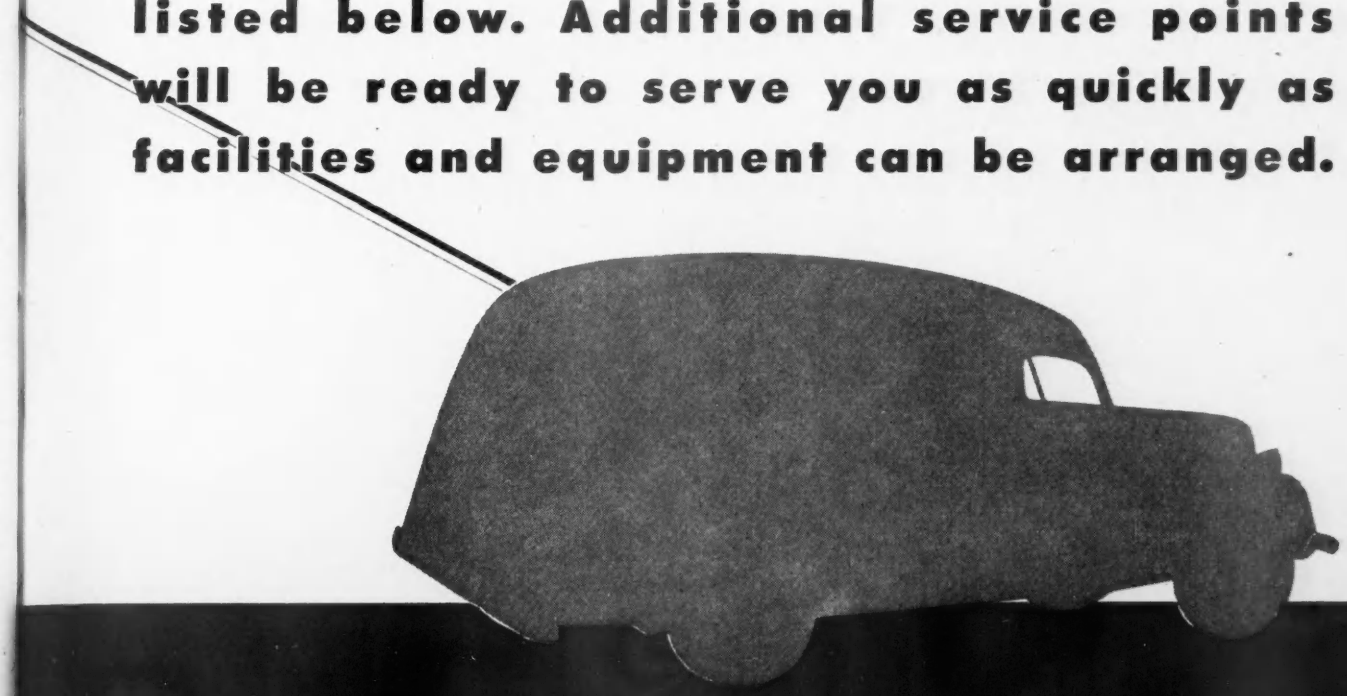

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Sand Face Cleaning With *Lye, Aluminum,* and *Oil*

By F. R. COZZENS
Field Foreman, Equity Oil & Gas Company

UNDER certain conditions, a combination of remedies proves better than a single remedy used alone. This holds especially true in reviving stripper wells in areas where little or no gas or water is produced with the oil, and a sluggish gathering system makes it necessary to use a multiple cleaning action against the sand face to remove residue and wax. Such areas generally respond quite favorably to various oil recovery measures, once impediments have been removed, but since there is insufficient driving energy to force sediment into a well, reconditioning effects must be accomplished almost entirely from within the shot-hole. The cleanout program must therefore be arranged with three objectives in mind: first, to dissolve waxes of various types (crystalline and amorphous); second, to break down crystallized structures which bind together and hold waxes to the sand face; and third, to cause sufficient "scaling" or sloughing-off of the sand face surface so that plugging materials can be removed from behind it.

To meet these triple requirements, it is generally necessary (and often less expensive) to use some form of chemical action to establish and maintain for a certain period of time a temperature of at least 170° F. within the shot hole. Chemicals are given preference in many localities because the working technique can be carried out by the average drill crew, and temperature action can be distributed more evenly over the sand-face surface. In choosing chemicals for reconditioning jobs, it must be remembered that anywhere from 40 to 60 percent of the heat generated by the agent is wasted during the cleaning process, so that for most effective results, the agent (or agents) must be capable of producing fully twice as much heat as is actually required. In this respect, chemical combinations work to much better advantage than single chemicals. The heat ratio can be maintained at a higher degree, effects are more diversified, and there is more uniform action within the shot hole.

Chemical combinations must be made up so that the various agents employed will harmonize or blend well together, and one recipe that is widely approved by eastern oil field stripper operators is a combination of lye (caustic soda), and metallic aluminum, generally supplemented with specially treated crude oil. Oil is used mainly to provide the bulk of the fluid volume in the shot hole. Where oil is used to replace as much water as possible, less chemical volume (weight) is required to build up the necessary shot hole temperature and there is less waste of energy. While fresh water is a basic element in chemical action, it must be remembered that too much or too little water will reduce the efficiency of the chemical agents. The working formula generally recommended for the lye-aluminum combination is one-fourth gallon of water to each pound of dry chemicals, or, on a barrel-volume basis, six pounds aluminum, 24 pounds lye, 7.2 gallons of fresh water, and 34.8 gallons of oil for making up each barrel (42 gallons) of shot hole fluid.

Determining Capacity of Shot Hole

In the chemical reconditioning of a well, the first requirement is to know the capacity of the shot hole, so that the correct amounts of ingredients can be assembled on the job. If cleanout tools are being used in connection with the reconditioning work, shot hole capacity can be easily ascertained by measuring water into the well by a bailer provided with a dump rod of sufficient length to reach the top of pay sand. When the shot hole is completely filled, some water will remain in the bailer on the up-pull. From capacity measurements, it is a simple matter to estimate the number of pounds or gallons of each ingredient required, so as to avoid waste of materials, and the shot hole capacity figures then should be made a part of the well record for future reference. Lye is usually purchased in bulk, in air-tight containers. Metallic aluminum is preferred in pellet form. The source of the necessary fresh water should be free of salt, sediment, or floating residue, and crude oil is generally treated with drip gasoline, one-part gasoline to every three parts oil. All materials should be calculated and assembled before operations begin, because an hour's delay later can easily ruin an otherwise successful job. If wells are known to have been cased in the top of the sand, it usually is wise to lift the casing off the shoulder for a few feet until cleanout work is completed. The crew should be careful of burns when dumping chemicals into the well and avoid inhaling the fumes which issue from the casinghead while operations are in progress.

The operating procedure is carried out by first bailing the hole as dry as possible, then measuring in the required amount of fresh water indicated by the shot hole measurements. This is followed by the calculated amount of dry lye, which is gradually fed into the well through a funnel placed in the casing top and washed down with one-half to two-thirds the calculated quantity of treated oil. The aluminum pellets are then fed through the funnel and washed down with the remainder of the oil, until the shot hole is filled. Considerable time and labor can be saved by having oil and chemicals measured beforehand into

CREATION OF elevated temperatures at the sand face through introduction of balanced chemical ingredients effectively removes paraffin and cleans the producing area. The author recommends practice for divergent conditions and outlines steps which prevent loss of production after chemical heat-treating.

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drums or suitable containers and placed within dumping range of the casing top. It is also advisable to provide a maximum reading thermometer which can be attached to the bailer-dart or to a weighted steel measuring line. The thermometer should be run into the shot hole at least once every hour after chemical reaction begins to determine the progress of operations and to detect temperature fluctuations which might arise from unexpected causes.

Determining Fluid Temperature

Temperature rise begins immediately upon contact of lye and aluminum with water, and the maximum shot hole temperature is generally reached within three hours. At the end of a three-hour period, a thermometer placed in the shot hole of the average well will register 200 degrees F. or higher. Fluid temperature near the center of the shot hole, however, will be anywhere from eight to 20 degrees higher than at the walls of the well, due to heat absorption by the sand and by residue being dissolved from it. Certain wells absorb more heat than others, and because of this fact, a maximum fluid temperature must be held for from six to eight hours so that a uniform dissolving heat of at least 170° F. can be established over the sand face surface.

The thermometer should be run into the hole frequently and if a temperature decline begins prematurely, a part of the shot hole solution (one to three barrels) is bailed out and replaced with an equal quantity of fresh solution, mixed in the same proportions as before. Uniform distribution of heat also can be encouraged by stirring the shot hole solution with the drill for half-hour periods, keeping the bit one to three feet off bottom. Some operators make it a practice to run the drill continuously during the entire heat period. Continuous drill stirring, however, is seldom necessary, and it occasionally terminates in a fishing job, because heat expansion causes the "jumping" of pins on the tools. If the chemicals used on a job are fresh and potent and have been applied in correct quantities, there will be little or no difficulty in holding a satisfactory temperature for from six to eight hours.

Emptying the Shot Hole

When the normal cooling off period finally begins, and temperature has declined to around 80° F., the shot hole should be emptied as quickly as possible, otherwise, the soapy sludge formed by chemical reaction will start to settle out and become difficult to remove. Many favorable cleanout jobs have been ruined by allowing chemical solutions to become cold before removal, or by failure to remove sandscale which continues to slough off for several hours after bottom-hole temperatures have become normal. After the shot hole has been made as dry as possible, there should be several vigorous wash-downs with gasoline treated oil. The treated well is generally allowed to remain open for ten to 12 hours, then given a final wash-down with oil, after which tubing and rods are returned, and the well made ready for pumping, unless it has been necessary to lift the casing. In such cases, the shoulder or casing seat must be checked for possible damage. If much damage has occurred, a temporary bridge is made across the bore immediately below the casing point, and enough cement slurry poured in to form a new shoulder or provide an extension for the damaged one, after which the casing is re-seated and the bridge drilled out. If the well is to be used as an air or gas input, a very common practice is to run a string of three-inch diameter line-pipe on a cemented packer to a point a little below the casing shoulder. After the cement has hardened, the casing is pulled from around the pipe.

While cleanout tools have a very important place in reconditioning work, lye, aluminum and oil treatment can be utilized with a fair measure of success without them, provided the capacity of the shot hole is known or can be determined. The treating procedure is to pump the shot hole as dry as possible, first making sure (through measurements) that the working barrel is located at, or very near, the bottom of the hole. Tubing and rods are then removed, and lye and aluminum in calculated quantities, along with the necessary water and oil, are poured down the open hole. Temperature progress is ascertained at frequent intervals by ruinning the thermometer on a weighted steel measuring line. Agitation of the fluid is dependent entirely upon the chemical reaction, but if the temperature rise is too slow, the difficulty can be overcome usually by dropping in extra small quantities of chemicals, in proportions of five pounds ly to one pound aluminum for each barrel of fluid in the shot hole. When the final cooling off period is reached, and fluid temperature has dropped to around 80° F., the tubing and rods are returned, making extensions if necessary, so the well pumps from the bottom of the shot hole until that cavity has been emptied of fluid and residue. Tubing and rods are again pulled out and cleaned thoroughly of chemical sludge which invariably clogs the working barrel, valves, and seats. The shot hole cavity is then filled with gasoline treated oil or with drip or casinghead gasoline, which serves to wash down the sand face and to remove accumulated sand-scales.

When tubing and rods are returned to their original pumping position in the well, many operators apply a fine wash-down by circulating ten to twenty barrels of fresh, crude oil through the shot hole. This is done by continuous pumping for a six- to eight-hour period, while the lead line is arranged to discharge back into the well, between casing and tubing. Under no circumstances should lye or aluminum be allowed to remain in any part of the pumping equipment. Where cleanout tools are not available, it is not advisable to drop or pour these chemicals down the casing of wells having long stretches of open hole which are likely to cave. In treating such wells, the chemicals should be lowered into the shot hole in screen-wire containers, attached to a wire line of sufficient length.

Removing Chemical Solutions

In lieu of cleanout tools, it has become a practice in a few districts to blow or force spent chemical solutions out of a shot hole with compressed air. Unless a standard (repressuring) compressor is available, a portable three-stage unit provided with an accumulator air tank is used. The procedure is to locate the compressor about one hundred feet distant from the well, and provide sufficient tubing (generally 1½ inches in diameter) to reach from the compressor to the bottom of the shot hole. Tubing is run into the well during the chemical heating period, and when fluid temperature has declined to around 80° F., the air stored in the accumulator tank is released into the tubing. Contents of the shot hole are forced up and out of the well between casing and tubing until the cavity is emptied. For an effective job, the volume of air compressed into the storage tank must be five to ten times greater than the volume of the well, and the method is seldom practical for chemical cleanouts in wells deeper than 1000 feet. Various methods of removing shot hole fluids have no influence on sand face treatment, except to remove residue which has resulted from chemical action.

While formulated primarily for the cleaning of wells in sandstone formations, the combination of lye-aluminum and oil has given good results in areas having a lime content as high as 40 percent and induces especially favorable action on wells where mineral salts, oxide deposits, etc. (precipitated from crude oil), are waxed to the sand face surface. In these, as in various other types of sluggish wells, a three-way shot hole action is necessary for effective results. A combination of lye-aluminum, and oil has the ability to provide such action under practical field conditions. This means fewer reconditioning failures, longer lasting benefits, and a much higher percentage of gained or recovered oil.

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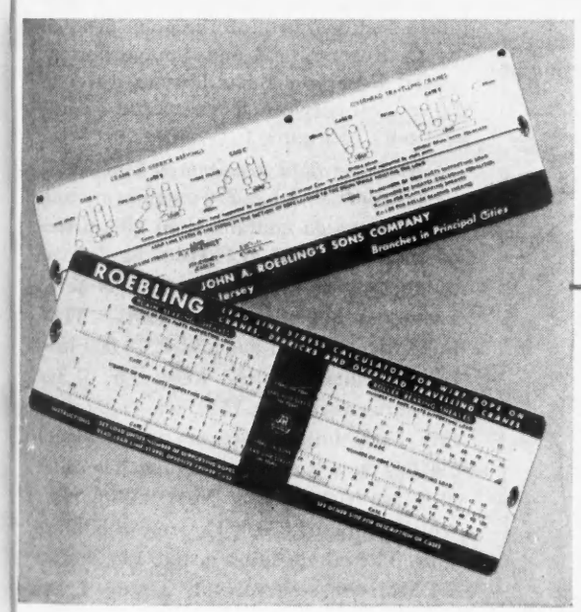

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Condensate PRODUCTION AND CYCLING

Part 19

Three Reservoirs Produced Simultaneously

By PARK J. JONES

A CYCLING program is mapped out for producing three small reservoirs simultaneously. At least two wells are required to cycle a reservoir. The maximum efficient rate, the MER, equals the producing capacity of wells. Such a MER may be greater than the optimum rate for a plant operator and less than the optimum for cycling and sales gas combined. The prospective per-reservoir gas rate, liquid rate and composition of composite production will be considered in the next article.

A distinction is made between the optimum rate of production, ORP, and the maximum efficient rate of production, MER. The rate of production which maximizes the present value of a reserve is the ORP. Suppose a cycling project is managed by a plant operator on the basis of an override. The probability is that the optimum rate of cycling from the viewpoint of the plant operator is not the ORP from the viewpoint of the working interest. A rate of production which would reconcile the conflicting interests equitably is called the MER. The corresponding rate would depend on a number of factors including the magnitude of the override.

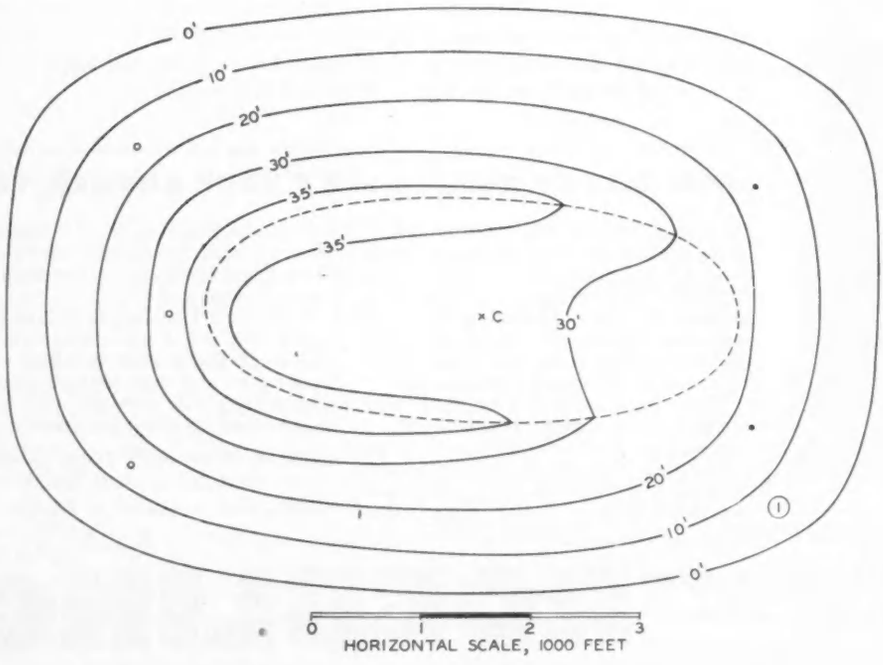


Figure 19-1. Pay thickness in reservoir 1; no water in crestal region.

Three Small Reservoirs

Consider the three reservoirs mapped out in Figures 19-1 through 6. The first three maps show the pay thickness. Figures 4 and 5 are west-east and south-north sections through the point denoted by C. Reservoirs 2 and 3 have bottom water. Reservoir 1 has bottom water in the region between the zero and dashed contours of Figure 1.

The basic data are itemized in Table 19-1. Reservoir 1 has 856 acres averaging 19.5 feet which contain 31.10 billion feet of rich gas and 3,110,000 barrels of butanes plus. Reservoir 2 has 494 acres averaging 12.0 feet which contain 11.41 billion feet of rich gas and 1,370,000 barrels of butanes plus. Reservoir 3 has 458 acres averaging 11.1 feet which contain 11.80 billion feet of rich gas and 590,000 barrels of butanes plus. The total in place rich gas is 54.31 billion feet which contain 5,070,000 barrels of butanes plus. The composition is 100, 120, and 50 BPMM for reservoirs 1, 2, and 3, respectively.

Producing Rate

At least one injection and one producing well are required to cycle a reservoir or maintain pressure with water. An injection well may be dualled. But a condensate producing well may not be

dualled because of corrosion. The risk associated with corrosion may be greater than the difference between the cost of two single and one dual completions. On the other hand, two or three producing or injection wells may be used to an advantage in a reservoir. Composition of in place fluids, structure, and stratigraphy determine the minimum well investment. The minimum number of wells have a capacity of Q million per day. Should the plant capacity also be Q or some smaller value such as q and the wells pinched in to plant throughput.

Let y equal the payout in years when the producing rate is at well capacity Q and n the payout for a comparatively slower producing rate q. Then at payout,

$$AQy = W + PQ \qquad (1)$$

and

$$Aqn = W + Pq \qquad (2)$$

from which

$$y = \frac{W}{AQ} + \frac{P}{A} \qquad (3)$$

and

$$n = \frac{W}{Aq} + \frac{P}{A} \qquad (4)$$

where

W = total well investment,
P = plant investment per unit capacity,
A = operating income per unit producing rate.

Evidently, the producing rate at well capacity Q has a quicker payout than a comparatively slower rate even if the plant investment P per unit capacity and the net income were independent of plant size. But a cycling plant investment increases from $35,000 to, say, $45,000 per million daily capacity as the size of a plant decreases from, say, 25-10 million barrels per day capacity. Moreover, a comparatively slower producing rate has a higher operating expense. An operating income is less than proportional to producing rate at slow enough producing rates. Therefore, the MER for the foregoing conditions equals the producing capacity of wells. Such a MER may be greater than the ORP for

TABLE 19-1
Basic Data for Reservoirs 1, 2 and 3

Reservoir	1	2	3
Productive acres	856	494	458
Average pay thickness, feet	19.5	12.0	11.1
Acre-feet of pay	16,690	5930	5080
Average porosity, percent	24	24	24
Average interstitial water, percent	20	25	25
Reservoir space, bbls/acre-foot	1490	1390	1390
Reservoir space, million bbls.	24.87	8.24	7.06
BPMM	100	120	50
Bbls space/bbl C_{4+}	8.00	6.00	12.00
In place, C_{4+}, million bbls.	3.11	1.37	0.59
MCF rich gas/bbl C_{4+}	10.00	7.33	20.00
In place, rich gas, billion feet	31.10	11.41	11.80
Total rich gas = 54.31 billion feet	.....	.....	.....
Total butanes plus = 5,070,000 bbls.	.....	.....	.....

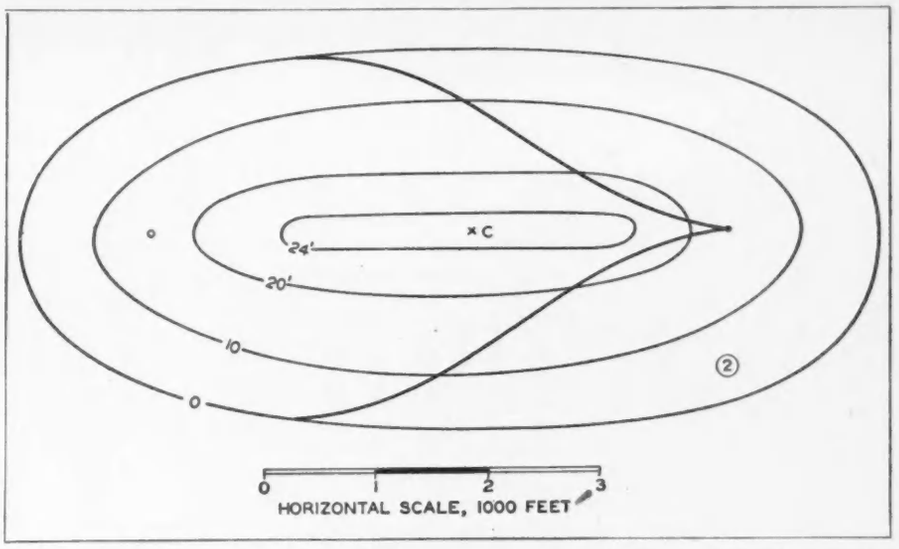


Figure 19-2. Pay thickness and estimated breakthrough pattern for reservoir 2; entire area has bottom water.

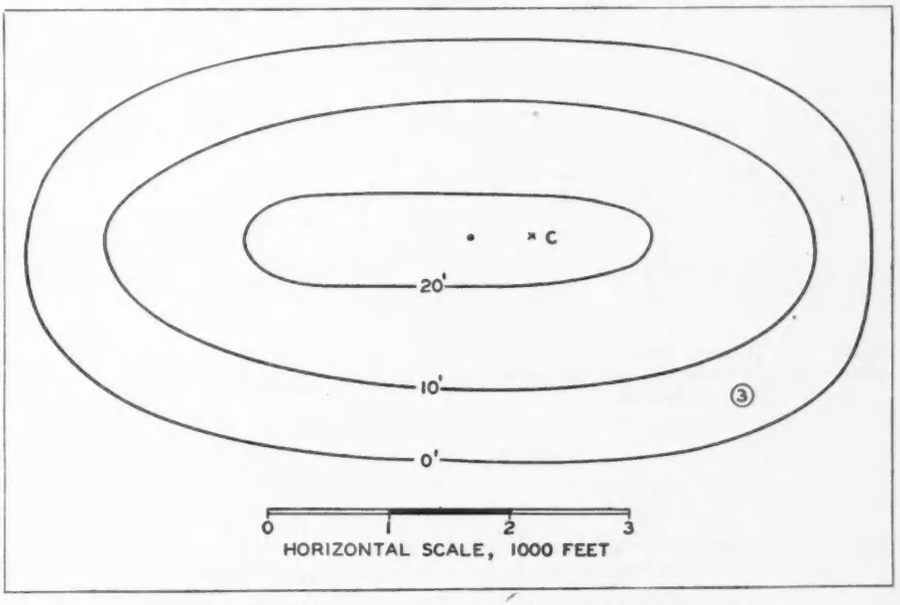


Figure 19-3. Pay thickness in reservoir 3; entire area has bottom water.

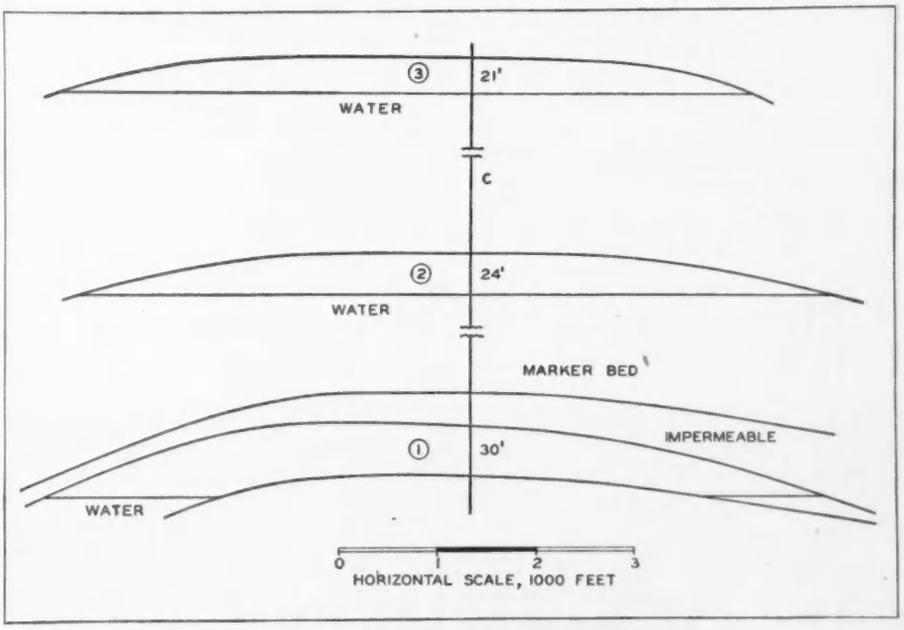


Figure 19-4. W-E section through point C of reservoirs 1, 2, and 3.

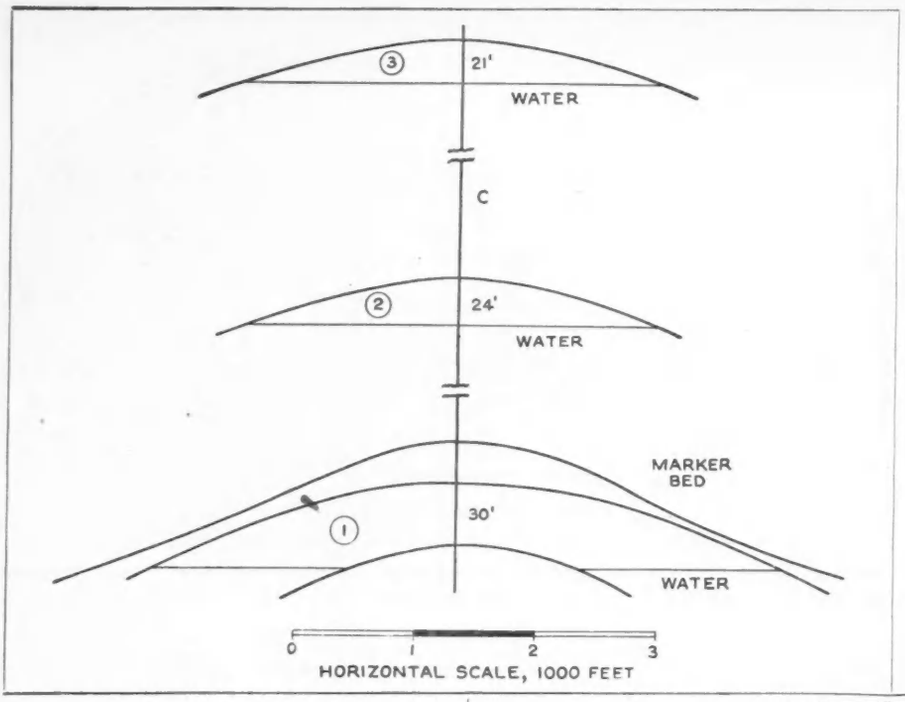


Figure 19-5. (Above) S-N section through point C of reservoirs 1, 2, and 3.

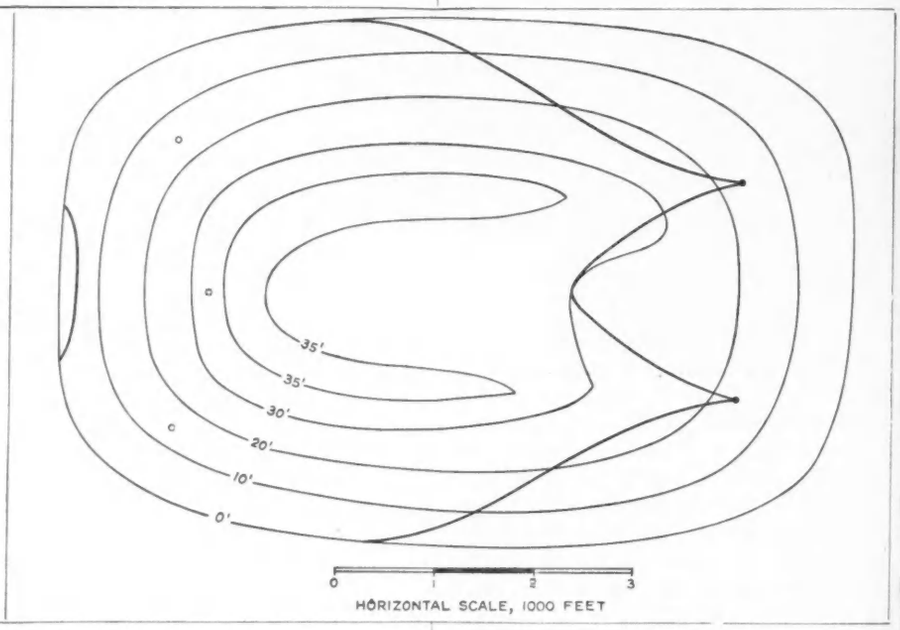


Figure 19-6. (Center) Estimated breakthrough pattern for three injection and two producing wells in reservoir 1.

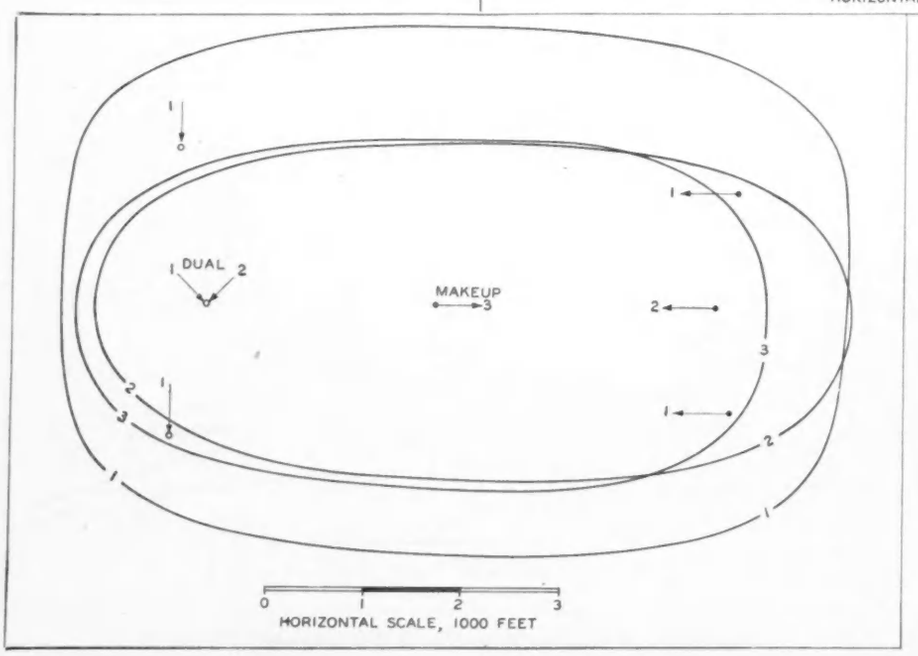


Figure 19-7. (Below) A cycling program for reservoirs 1 and 2 with makeup from 3.

a plant operator and less than the ORP for cycling and sales gas combined.

A Cycling Program

A cycling program is mapped out in Figure 19-7 and itemized in Table 19-2. The producing capacity is 17 million per day from reservoirs 1 and 2. One well is produced at three million per day from reservoir 3. The residue gas from reservoir 3 is injected into reservoirs 1 and 2.

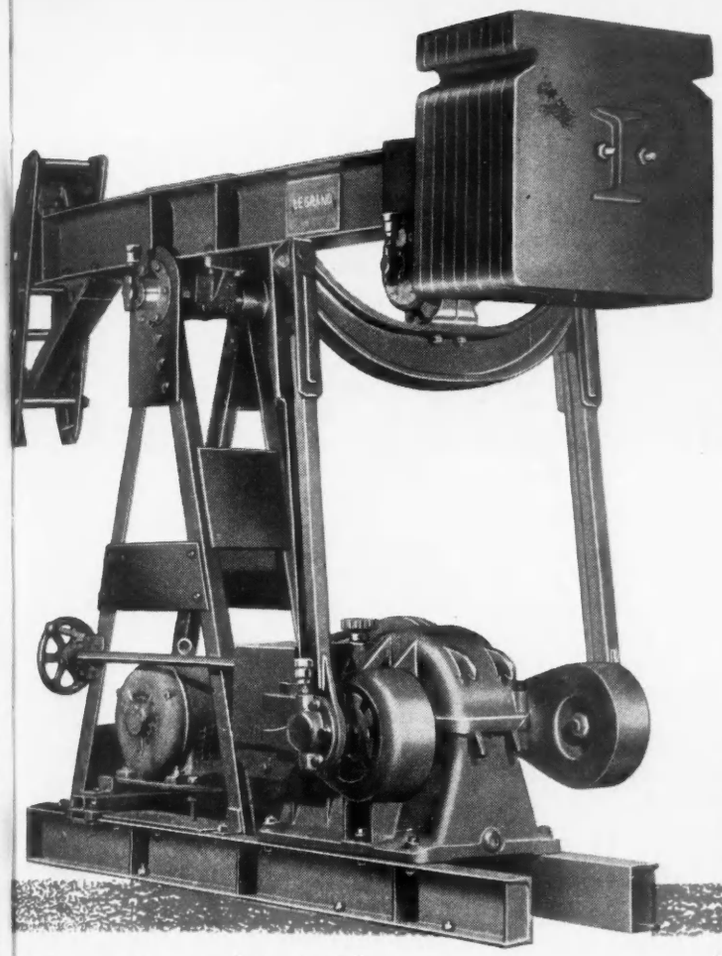
The total rich gas rate is 20 million barrels per day and the initial liquid rate 1950 barrels per day. Injection rate is 17.0 million barrels per day. Composition prior to breakthrough is 97.5 BPMM. Breakthrough for uniform per-reservoir permeability is estimated at 70 percent for reservoir, Figure 19-6, and 50 percent for reservoir 2, Figure 19-2. Breakthrough is relative to displaceable gas and not in place gas.

Injected gas could displace 90 percent of the in place rich gas provided cycling were continued indefinitely. But gas injection would not be continued beyond a cycyling economic limit. The latter is taken at 15 BPMM or 15 percent for reservoir 1 and 12.5 percent for reservoir 2, Table 19-2.

TABLE 19-2
A Cycling Program for Reservoirs 1 and 2

	RESERVOIR			
	1	2	3	Total
In place, billion feet	31.10	11.41	11.80	54.31
In place, million bbls.	3.11	1.37	0.59	5.07
Producing capacity, million/day	12	5	3	20
Producing capacity, bbls/day.	1200	600	150	1950*
Shrinkage and fuel, percent	15	20	6	.....
Injection, million/day	12	5	None	17.0*
Displaceable rich gas, percent	90	90	70	.....
Displaceable rich gas, billion feet	27.99	10.27	8.26	46.52
Displaceable liquid, million bbls.	2.799	1.232	0.413	4.444
Breakthrough recovery, percent	70	50	.....	.....
Cycling economic limit, percent	15	12.5	.....	.....

* Liquid producing rate decreases, and dry gas injection rate increases, after breakthrough.



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★ **Unit illustrated is the Beam Balanced BC.6/24 Model 20,000 lbs. ins. Peak Torque Polished Rod load 6,000 lbs. Polished Rod Stroke 12″, 14″, 16″, 18″, 20″, 22″, 24″.**

Other units as detailed below:

C.3/24 Peak Torque - 9,000 lbs. ins.
Polished Rod Load - 3,000 lbs.
Polished Rod Stroke - 12″, 18″, 24″.

C.4/24 Peak Torque - 12,000 lbs. ins.
Polished Rod Load - 4,000 lbs.
Polished Rod Stroke - 12″, 14″, 16″, 18″, 20″, 22″, 24″.

C.5/28 Peak Torque - 20,000 lbs. ins.
Polished Rod Load - 5,000 lbs.
Polished Rod Stroke - 12″, 17″, 22″, 28″.

C.7/40 Peak Torque - 35,000 lbs. ins.
Polished Rod Load - 7,000 lbs.
Polished Rod Stroke - 19″, 26″, 33″, 40″.

C.8/34 Peak Torque - 55,000 lbs. ins.
Polished Rod Load - 8,000 lbs.
Polished Rod Stroke - 16″, 22″, 28″, 34″.

C.10/34 Peak Torque - 35,000 lbs. ins.
Polished Rod Load - 10,000 lbs.
Polished Rod Stroke - 16″, 22″, 28″, 34″.

C.10/34 Mk. II. Peak Torque - 35,000 lbs. ins.
Polished Rod Load - 10,000 lbs.
Polished Rod Stroke - 16″, 22″, 28″, 34″.

CC.10/34 Peak Torque - 55,000 lbs. ins.
Polished Rod Load - 10,000 lbs.
Polished Rod Stroke - 16″, 22″, 28″, 34″.

CC.10/34 Mk. III. Peak Torque - 35,000 lbs. ins.
Polished Rod Load - 10,000 lbs.
Polished Rod Stroke - 16″, 22″, 28″, 34″.

CC.10/42 Peak Torque - 55,000 lbs. ins.
Polished Rod Load - 10,000 lbs.
Polished Rod Stroke - 21″, 28″, 35″, 42″.

CC.10/42 Mk. II. Peak Torque - 55,000 lbs. ins.
Polished Rod Load - 10,000 lbs.
Polished Rod Stroke - 21″, 28″, 35″, 42″.

BCC.10/42 Peak Torque - 55,000 lbs. ins.
Polished Rod Load - 10,000 lbs.
Polished Rod Stroke - 21″, 28″, 35″, 42″.

BCC.10/42 Mk. III. Peak Torque - 55,000 lbs. ins.
Polished Rod Load - 10,000 lbs.
Polished Rod Stroke - 21″, 28″, 35″, 42″.

CC.10/60 Peak Torque - 140,000 lbs. ins.
Polished Rod Load - 10,000 lbs.
Polished Rod Stroke - 24″, 34″, 44″, 54″, 60″.

CC.15/48 Peak Torque - 98,000 lbs. ins.
Polished Rod Load - 15,000 lbs.
Polished Rod Stroke - 21″, 30″, 39″, 48″.

CC.15/48 Mk. II. Peak Torque - 98,000 lbs. ins.
Polished Rod Load - 15,000 lbs.
Polished Rod Stroke - 21″, 30″, 39″, 48″.

CC.15/48 Mk. IV. Peak Torque - 98,000 lbs.ins.
Polished Rod Load - 15,000 lbs.
Polished Rod Stroke - 21″, 30″, 39″, 48″.

CC.15/54 Peak Torque - 140,000 lbs. ins.
Polished Rod Load - 15,000 lbs.
Polished Rod Stroke - 24″, 34″, 44″, 54″.

CC.15/54 Mk. II. Peak Torque - 140,000 lbs. ins.
Polished Rod Load - 15,000 lbs.
Polished Rod Stroke - 24″, 34″, 44″, 54″.

CC.15/72 Peak Torque - 200,000 lbs. ins.
Polished Rod Load - 15,000 lbs.
Polished Rod Stroke - 24″, 36″, 48″, 60″, 72″.

CC.20/66 Peak Torque - 200,000 lbs. ins.
Polished Rod Load - 20,000 lbs.
Polished Rod Stroke - 20″, 33″, 44″, 55″, 66″.

CC.25/72 Peak Torque - 330,000 lbs. ins.
Polished Rod Load - 25,000 lbs.
Polished Rod Stroke - 24″, 36″, 48″, 60″, 72″.

CC.25/86 Peak Torque - 330,000 lbs. ins.
Polished Rod Load - 25,000 lbs.
Polished Rod Stroke - 30″, 44″, 56″, 72″, 86″.

CC.31/108 Peak Torque - 600,000 lbs. ins.
Polished Rod Load - 31,000 lbs.
Polished Rod Stroke - 44″, 60″, 76″. 92″, 108″.

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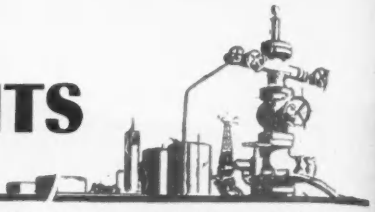
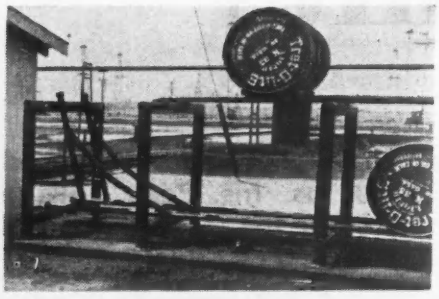


$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

HOW TO—Construct Simple, Automatic Chemical Drum Storage Rack

When a considerable quantity of treating chemicals is required at a dehydrating plant, the construction and erection of a drum rack will save time and eliminate back-breaking labor.



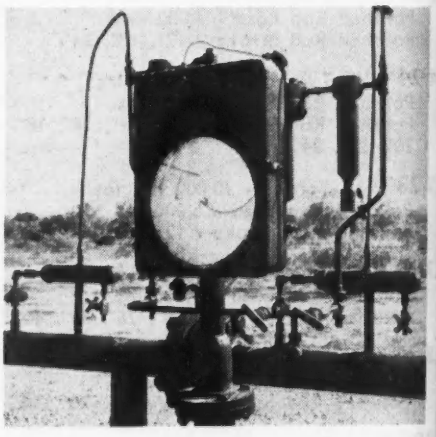
This rack is designed for simplicity and is made of common oil field pipe. Risers are cut to a length which provides a drum storage platform with the top section on a level with the average freight truck bed so that the filled drums can be quickly rolled from the truck to the rack. Cross members tie each pair of risers at the top and additional members are welded to each pair near the base which is fitted with flat plates attached to timbers or concrete piers with lag screws or foundation bolts. Extra heavy 1½ inch pipe is laid horizontally across the top cross members, spaced from each other so the stiffening ribs of the drums will pass on the inside to act as flanges to keep the drums rolling in line upon the rack. The last vertical pair of risers support pipe guides leading to the lower storage space which is used for empties.

A drum is used until empty, then it is rolled by the operator to the end of the storage platform and allowed to drop to the guides which pass the empty without further handling, to the storage space below.

HOW TO—Install Pots on Meters to Scrub Gas

Where wet gas is being measured, there is always a possibility that the entrained liquid will find its way up the meter piping and collect on the mercury column. One company has overcome this difficulty by installing a double set of pots on their meters which effectively scrub the gas.

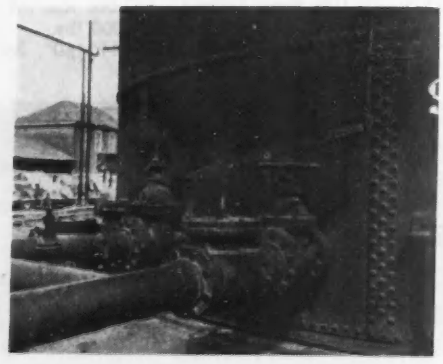
Two pots are used on the upstream side of the orifice flange and one on the downstream side. The upper scrubber shown in the photograph is of the usual construction with a drain which is opened each time the chart is changed. The other set of scrubbers is placed in a horizontal position to act as surge chambers.



When a slug of liquid comes through the water, they tend to separate the liquid and gas, and the pressure is conveyed to the mercury manometer without the danger of the liquid being carried along. As soon as the slug of liquid has passed the meter, most of the entraining liquid will fall back into the meter run. Drain cocks have been provided to keep the pots empty and as a check to see if liquid has been passing the meter.

HOW TO—Connect Tanks for Bottom Filling

Where water is run from a stock tank to other tanks on a lease by means of gravity flow, it is sometimes difficult to get the water to run into a tank unless the stock tank is sufficiently full to cause the water to gravitate over the riser into the receiving tank.

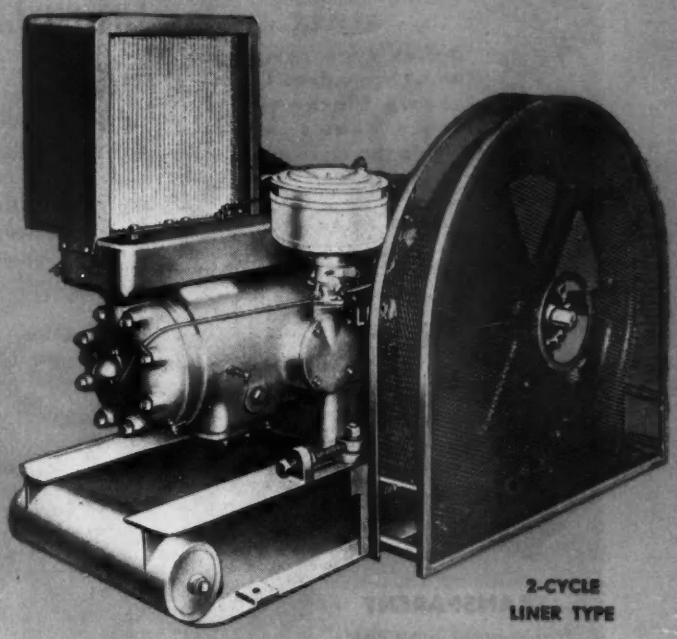


In order to get the water into the receiving tank even if the stock tank is only partly full, one company places the inlet on the bottom. This allows the tank to fill up to the level of the stock tank without it being necessary for the stock tank to be full.

A float on the receiving tank is placed so that it will shut off the water flow in case the receiving tank becomes full. In order to connect to the double-seated valve on the inlet line, a rod is run through loops to the top of the tank and down to the valve on the outside. Whenever the water rises to a predetermined level, the inlet valve is automatically shut off. A bypass around the inlet valve allows water to be used on other necessary places when it is not necessary to be filling the tank.

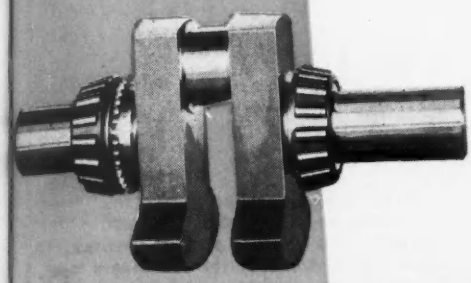
Types "L" and "O" "Oilwell"-Lorain Engines

...are adaptable to a wide range of oil-field applications

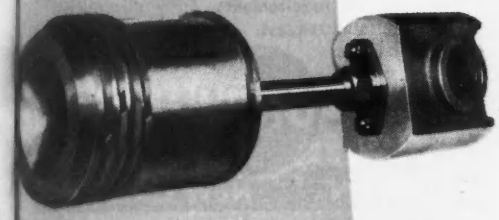


2-CYCLE
LINER TYPE

Outstanding Features

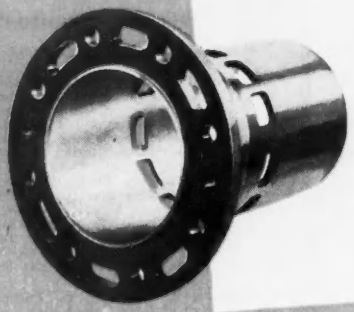


FORGED-STEEL CRANKSHAFT is mounted in heavy-duty tapered-roller bearings. Crankshaft is counterweighted to reduce torsional stress and bearing pressures. The large diameter crankshaft is machined to carry the pilot bearing for the clutch power take-off.



PISTON—Precision-ground piston is fitted with five rings assuring high compression, easy starting, and maximum power for continuous service. The flanged piston rod is bolted to both the crosshead and piston, thus permitting easy removal of piston for maintenance and service in the field.

CONNECTING ROD of the automotive type is drop-forged from alloy steel and heat-treated. It has a reinforced I-beam section with solid eye for crosshead pin and bushing. Connecting-rod cap is held in place by heat-treated, body-fitted bolts. The crank pin bearing is a replaceable, shim-adjusted bronze backed babbit lined shell.



CYLINDER LINER is a wet-sleeve type and is made from alloy cast-iron to assure long life. It is quickly and easily replaced on location; eliminating costly reboring jobs, minimizing down-time, and maintaining standard dimensions.

THE "OILWELL"-Lorain Type "L" and Type "O" Engines are heavy-duty, single cylinder, two-cycle power units, built to withstand continuous service with minimum attention.

They have (1) condenser-type cooling system, (2) large capacity oil reservoir, (3) oil-bath splash lubrication for crankshaft and bearings with mechanical force-feed lubricator supplying positive lubrication to the liner and piston—all contributing to effective lubrication.

These engines are sturdy, compact and weatherproof, and can be equipped to operate on either natural gas or butane—and are convertible to cold-start Diesel engines.

BRIEF SPECIFICATIONS

"Oilwell"-Lorain Engine	Type "L"	Type "O"
Bore and Stroke ..... inches	7½ x 8	9½ x 10
R. P. M.	600	450
Horsepower	21.4	32
Mean Effective Pressure.....p.s.i.	40	40
Same Ratings for Gas or Diesel Fuel		

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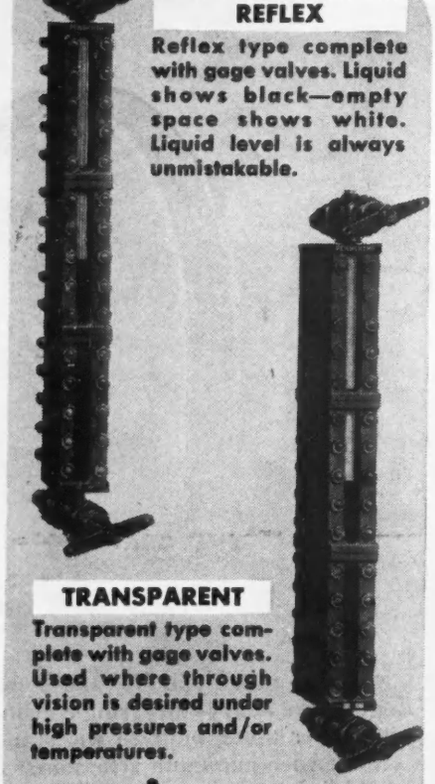
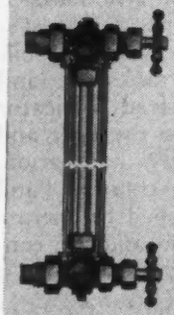


REFLEX

Reflex type complete with gage valves. Liquid shows black—empty space shows white. Liquid level is always unmistakable.

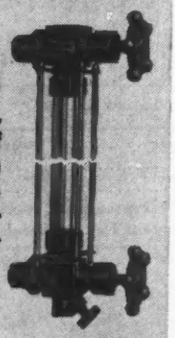
TRANSPARENT

Transparent type complete with gage valves. Used where through vision is desired under high pressures and/or temperatures.



DROP FORGED STEEL

Tubular glass type, Chrome-Moly temperature resisting steel body, stainless steel trim, regrinding removable seats.



ALL IRON

Tubular glass type, extra heavy body of special high strength alloy iron, shanks alloy steel, trim stainless steel, valves self-cleaning.

There is a Penberthy Gage of superior quality for every liquid level gage requirement. Gages are fabricated to customer's specifications from special alloys to meet unusual corrosive and temperature conditions. All Penberthy Gages conform with API-ASME requirements.

3277-B

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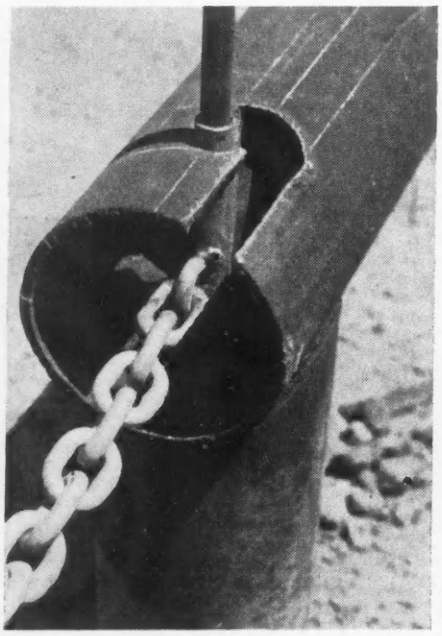
PENBERTHY INJECTOR CO.
Detroit 2, Mich.
Canadian Plant — Windsor, Ontario

PRODUCTION HINTS

HOW TO—

Fasten Chain-Type Gates

At wells or equipment stations where pipe rail fences are necessary to prevent entry, the opening for service vehicles is closed with a heavy chain. The company using this fence tried a variety of fasteners before hitting on the idea of a hook which needs a lever for unlocking.



The top rail of the fence is made of six-inch salvage pipe set on posts of similar material which are installed in concrete grouted holes. The open end of the rail at one side of the entry to the enclosure is slotted and provided with a hooked recess for the chain fastener. The fastener itself is a piece of one-inch heavy pipe reinforced at the back with a thick steel gusset plate securely welded with a bead on each side so the fastener will not bend easily.

The lower end of the fastener is provided with an iron rod hook welded in the open end of the one-inch pipe and which fits into a hole drilled or burned in the bottom side of the pipe rail directly below the hooked recess. The chain is attached to the fastener by welding a half-link which provides a hinged connection. Means for opening and closing the chain gate is provided by a bar of steel that acts as a lever so one person can obtain enough stretch on the chain to back the fastener from the hooked recess. Without this lever, unauthorized persons would have difficulty in unlocking the chain gate.

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PRODUCTION HINTS

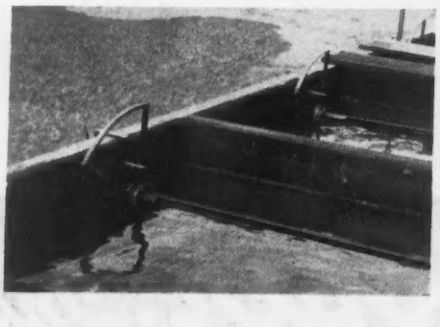
HOW TO—

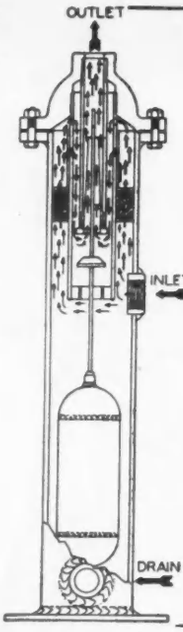
Control Skimmer Setting In Oil Skimming Pits

Where some salt water is produced with oil, and this water is gathered at one point, the water can be flowed into small streams if free of all oil. The problem of removing 100 percent of the oil has brought out some unique engineering designs. At the salt water disposal system employed by one company operating near the Gulf of Mexico, an efficient system skimmed off practically all remaining traces of oil before the salt water was permitted to flow into the bays and inlets. The system involves a process of successive skimming in concrete vats and skimming pits.

Of considerable interest is the method of controlling the skimmer setting. The skimmer is a section of four-inch pipe containing a longitudinal slot about one inch in width into which the floating oil flows. Each end of the skimmer is anchored to the concrete wall of the vat by means of short pipe nipples which are screwed into flanges connected to each end of the skimmer. One end is blanked off, so the overflow goes out only one end of the skimmer.

An angular bracket of strap steel is bolted to the flange at one end to provide a method of controlling the level of the horizontal slot. A clamp containing a hand screw and a projecting bar is fitted over the wall of the vat so that the project bar forms a stop for the bracket. The clamp may be set in any desired position to produce the most effective skimming. The skimmer can be adjusted through a wide angle with this device. The unit is made from galvanized metal and does not corrode.





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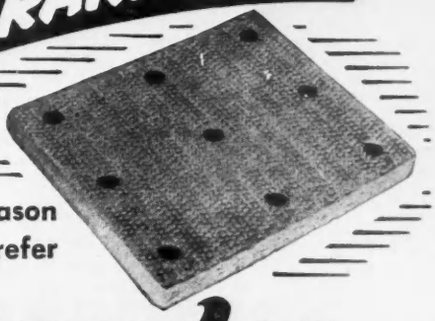

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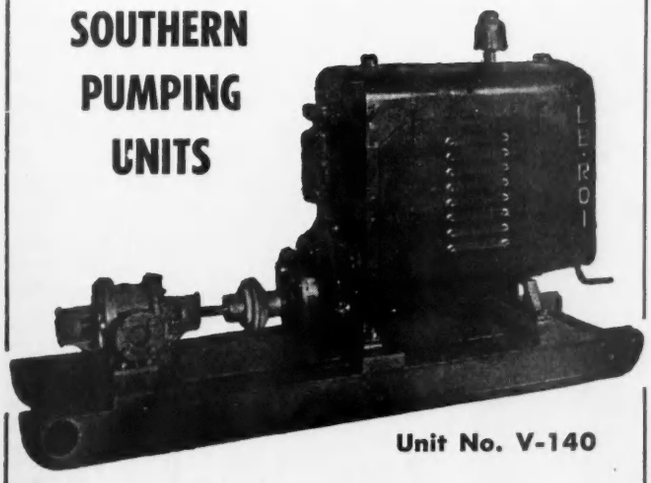

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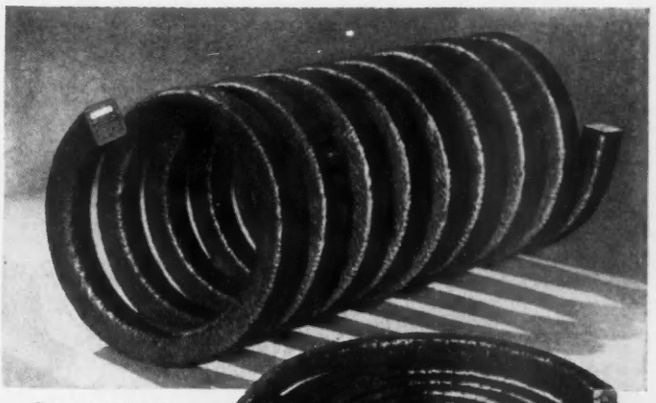

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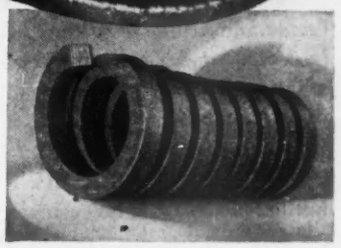

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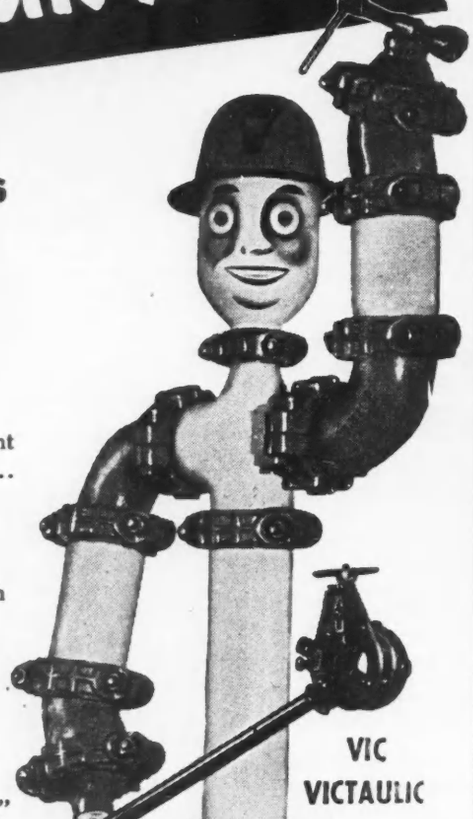

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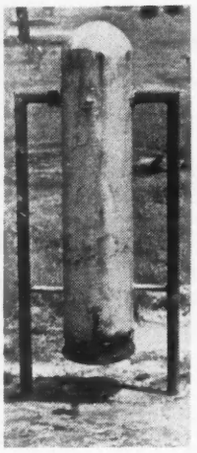
PRODUCTION HINTS

HOW TO—

Make Drip for Power Line

Entrained liquids in the gas flow to the engine driving the pumping units are removed by one producer through the installation of collectors in the two-inch lines at convenient low spots in the line.



The collectors or drips are formed from a 40-inch section of ten-inch pipe, with the ends orange-peeled to form pressure tight seals. The gas line enters near the top on one side, leaving at the same level directly opposite. The two-inch fuel line forms support for the drip, short one-inch nipples being welded between the outside of the drip shell and the two vertical two-inch pipes to stiffen the unit and relieve the welds in the two-inch of strain.

A nipple welded into the shell near the bottom carries a ½-inch valve, through which accumulated liquids are bled, under pressure of the gas within the unit.

A casing thread protector of the proper size is tack-welded to the bottom of the drip, to form a footing on which the unit may be supported while in storage and while the lines and brace nipples are being welded in place. After connections are complete, the blocking which supported the unit is removed, leaving it suspended from the gas feed line.

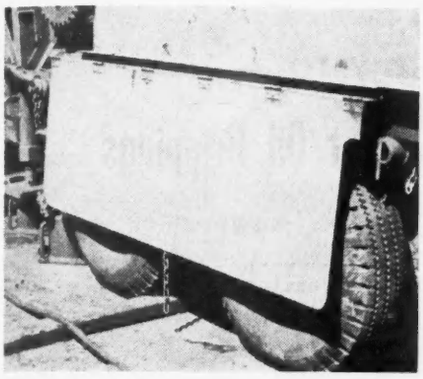
HOW TO—

Protect Pulling Unit Tires

Life of tires on the rear axle of heavy production service units may be lengthened considerably by providing a hinged leaf which can be dropped down over the wheels when the unit is set up at the well. Cut out of light steel plate, as shown, and provided with six hinges attached to a length of channel that is welded to the main frame of the unit, the protective shield is easily raised or lowered.

When the rig is being moved, the

plate is held in the raised position by means of a short length of chain that is attached to a fitting welded to the top side of the transmission drive housing. Because of oil, mud or chemical splashes which are injurious to rubber and which normally attack and deteriorate a tire long before the tread has given a normal length of service, the protective plate will repay its initial cost many times.



HOW TO—
Install Cutout Switch

Various types of cutout switches, which cut the ignition on the pumping unit engine when sucker rods part or other accident occurs, have been devised by field men. One device of unusual simplicity which is positive-acting is that employed by the production department of a large company.

It is a standard arc-proof switch which is clamped to the polished rod as shown in the photograph. On the opposite side of the rod is a small shelf of sheet steel which supports a steel weight, a three-inch length of round bar attached with a cord to the switch toggle. During normal operation the bar remains in place on the shelf, but should the rods part or the unit in some manner become unbalanced, the weight is thrown off, causing the switch toggle to be pulled down and the switch opened. This installation is easily removed when the well is pulled and is easily adaptable to any polished rod pumping unit.

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And you need not carry large inventories of bits as compared to conventional drag bits and roller bits because one bit head assembly lasts for many sets of blades.

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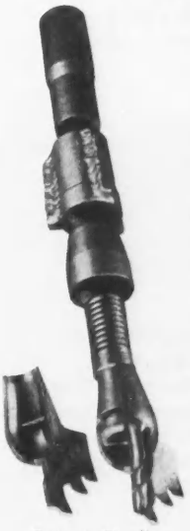

Patents Pending

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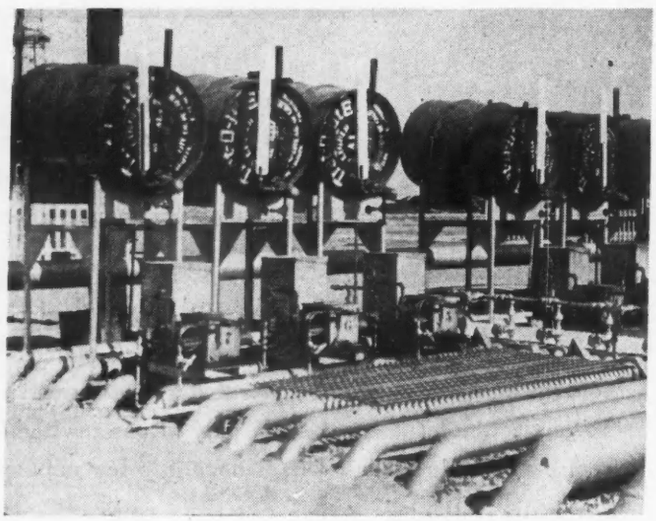
HOW TO—

Install Gauge Glass and Fittings on Chemical Shipping Drums

At treating plants where large quantities of chemicals are required to break the oil, one company has installed shipping drums on racks so the material may feed directly to the treating pumps. This eliminates frequent filling of small containers with resultant waste due to spills while measuring.



So that the quantity of the chemicals remaining in the drums may be seen easily, gauge glasses and fittings have been installed. Two-inch pipe fittings are made up to be inserted in the large bung hole. On one side of the nipple between the drum and the pump fittings is a connection to which a conventional gauge glass is attached. Top of the glass is open and the chemical shows the level in the drum by equalizing in the glass. Greater visibility is provided by setting "V" shaped guards painted white behind the glasses. Each guard is calibrated to show gallons as indicated by the top level of the chemical in the gauge glass. The attendant is able to determine at a glance which of the chemical drums require replacement.

HOW TO—

Collect Oil Drippings

Unsightly and potentially hazardous accumulations of oil around lead line or separator sample cocks are eliminated almost entirely by one company through the use of small, neat appearing troughs which collect such splashings or drippings. The device is simple to construct and requires only a small amount of light gauge sheet steel.

Two square sheets are welded together in a V-shape and the ends of the V then closed by two separate sheets, the latter also serving as legs of the unit. A fitting welded to the bottom at one end of the unit permits draining off accumulated fluids into the sump or collecting system. Painted aluminum, the trough presents a neat appearance, is easily spotted among pipe lines and fittings, and due to its inexpensive construction, can be used in numerous places about the lease.

On an Oil Field Trailer . . .

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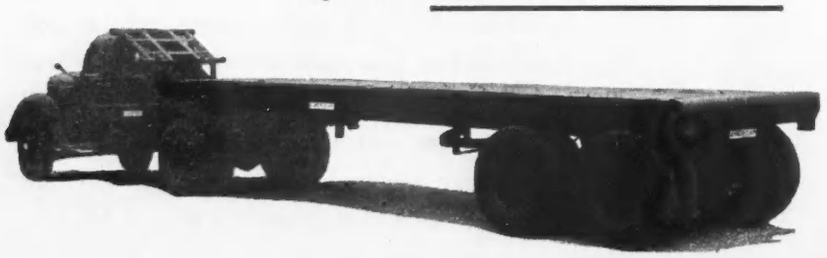

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LINE WELD CHECKING with Portable X Ray Unit

Elton Sterrett
Engineering Editor

FIGURE 1. Even when blocked off by a second section of pipe, the crane-equipped halftrack gets close enough to swing the cradle over to alignment with the open end of the line, where the lifting gear is used to hold the alignment of pipe and cradle until the traveling unit is energized.

DEVELOPMENT OF A mobile unit for transporting an X-ray tube within a line pipe provides for accurate checking of the entire circumference of a weld and thus provides any desired degree of completeness in determining the joining of abutting joints of pipe.

ADAPTED to pipe line requirements, the same X-ray technique which is specified in certain types of pressure-vessel weld inspection is contributing much to the quality of welds in trunk line construction. Unlike the coupon-test and other methods of weld inspection, the X-ray does not require drilling or cutting into the pipe after the welder has completed his work. The X-ray film encircles the weld, providing a complete picture of the entire job, full size and oriented for quick check-back in case of a defective junction.

The unit or "pig" which carries the X-ray tube is motor driven and capable of being run distances greater than the length of any section which good pipe line practice permits. The travel of the unit is dependent only upon the length of the electric cables attached to it and any voltage loss sustained in a long conductor.

The pig consists of a shell, supported on two pairs of driver wheels, set so as to span approximately one-third of the circumference of the pipe. A third pair of wheels, carried on a spring-loaded mounting, centers the unit in the pipe and provides against possible over-turning should the instrument spiral in its travel down a line.

A telltale or weld detector is carried out ahead of the pig on a spring-loaded trolley. This unit has a four-point star wheel which slides along the inside of the pipe until the forward point contacts a weld. The star wheel then is rotated one quarter turn, actuating a switch which breaks the circuit on a light at the control panel. A distinctly audible click is made, enabling the operator to locate the unit accurately within the pipe. By reversing and spotting the unit at the turn of the star wheel, the X-ray tube centered in the nose of the instrument is brought directly within the circle of the weld. The tube, shielded front and rear, is safeguarded against ray emanation except in the narrow band required to produce the weld picture on the film. The rays from the tube, during the 2½ minutes exposure required for the weld, are further filtered by the pipe walls, and intensity and duration are such that no hazard to personnel is involved. Inasmuch as welds are checked after the welding spread has completed its work, and before the cleaning and wrapping gangs have come up, only the operator

Acknowledgments are offered Tennessee Gas Transmission Company for permission to publish and for assistance in reaching the looping operations on its main line where the photographs were obtained, and for X-ray sections and their interpretation to the Industrial X-ray Engineers, developers of the method, and whose equipment was used in making weld inspections.

FIGURE 2 (Left). Supported in the cradle, the unit is ready to enter a 2500-foot section of line. The two rollers on the spring center the unit and provide uniform support regardless of the portion of the unit which is uppermost. At the end of the line is the telltale, which indicates welds and provides accurate report of the location of the unit, no matter how far down the line it has traveled.

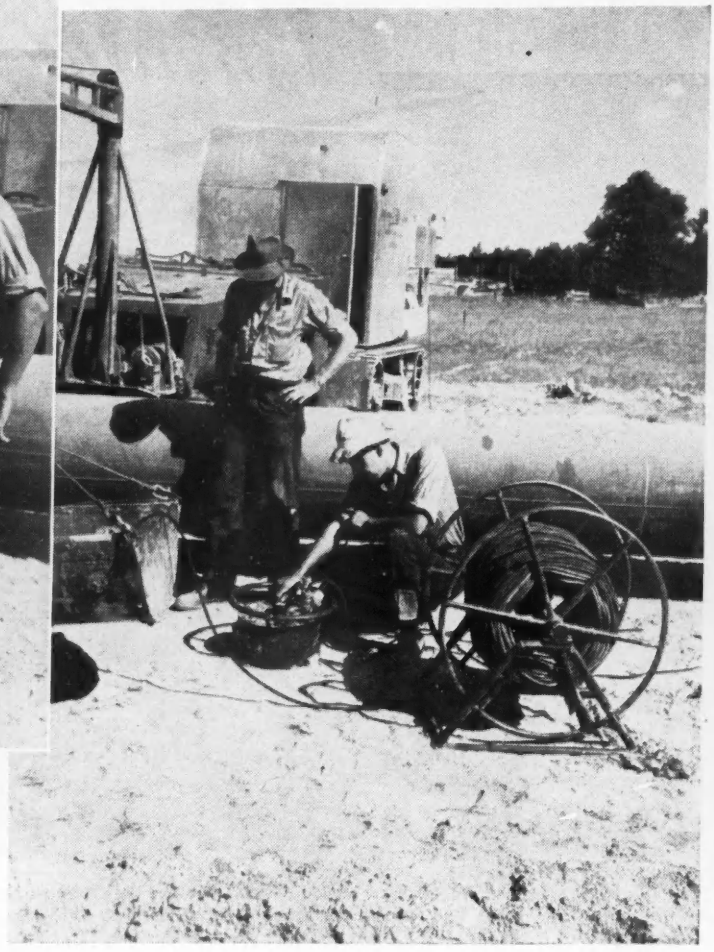


FIGURE 3 (Right). Control of the unit is through the panel shown. A rheostat permits control of the travel, while a small light bulb, blinking as the telltale crosses a weld, indicates the proper location for X-raying a weld. The wire reel, with 4000 feet of quadruple cable, carries separate leads for driving motor and X-ray coil controls.

of the unit is in the vicinity of the tube during the period it is energized.

Control of the driving motor on the pig is centralized on a small panel equipped with rheostat, signal light, and three-way safeguard for the X-ray coil. Two pairs of leads from the control panel distribute current to the two circuits, one for the driving motor, the other for the X-ray transformer. These leads are tied into a slip-ring device at the side of the reel, so that current segregation and continuity are assured no matter what position may be occupied by the reel.

Welds may be X-rayed and finished wet film ready for inspection within a few minutes, or a dry film made available within 30 minutes from the time of spotting the pig at the weld in the line. While normal practice specifies the recording of internal characteristics of 10 percent of the welds on a line, it is possible to run a complete check of all the welds made by a certain welder, or to inspect every joint in a river-crossing section or one which is to be so placed as to be especially vulnerable to leaks or imperfect junctions.

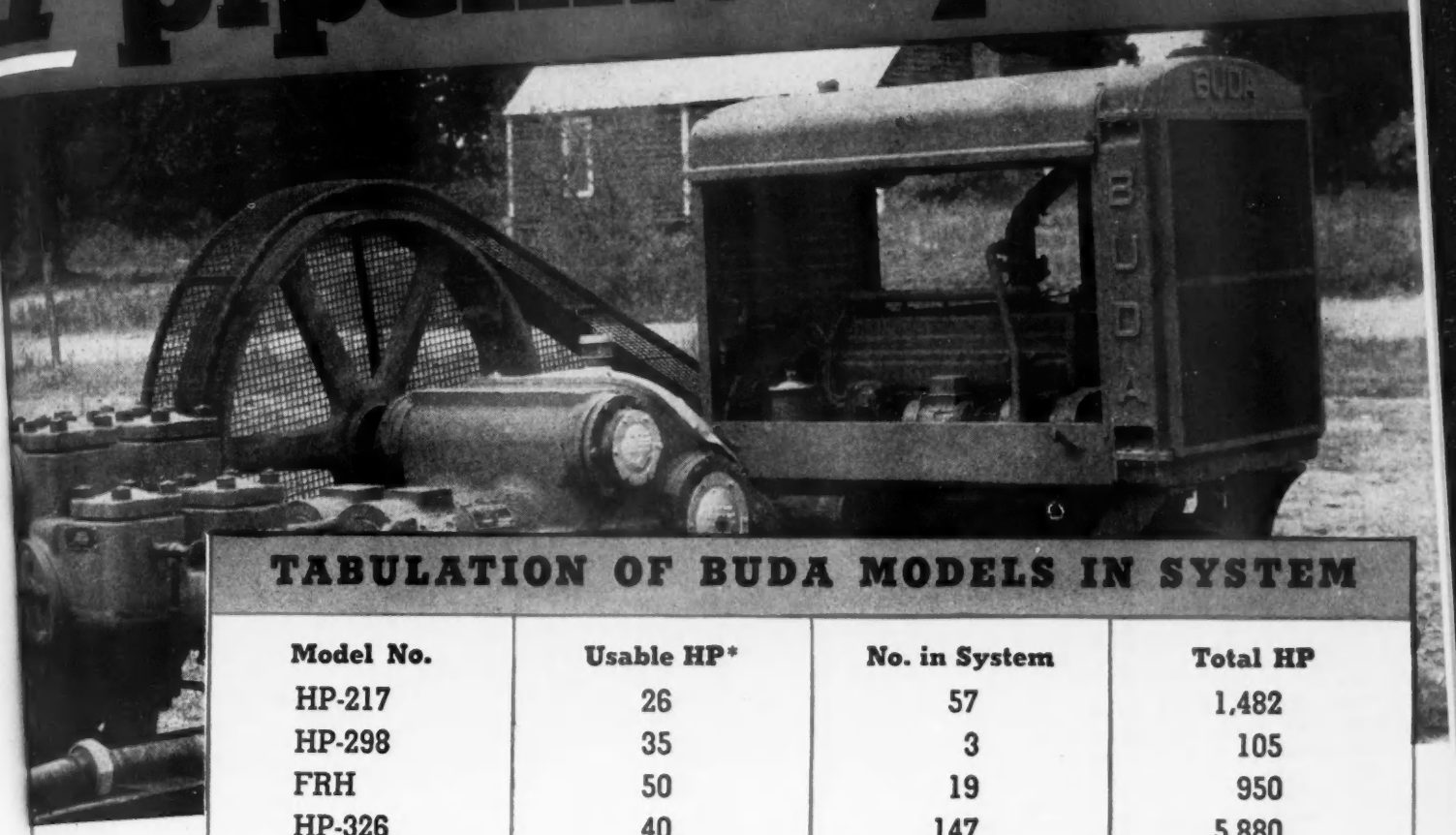
On one line where the X-ray inspection of welds supplanted the coupon method, not only the quality of the welds but also the number made stepped up surprisingly. The knowledge of adequate inspection spurred the welders on to better work and brought about faster work through the desire of the welder to eliminate areas where he had formerly allowed portions of the bead to cool unnecessarily.

The mobile unit which carries the pig is equipped with separate engine drive for a 110-220-volt generator which provides current for pig driving motor and for the transformer, as well as for the lighting requirements of the darkroom built onto the half-track which serves to carry all equipment. Loaded film carriers of the proper length to encircle the pipe being checked are stored in the darkroom and distributed at the designated welds. The carrier is loaded in the darkroom, the film being supported between a stainless steel strip on the emulsion side and lead strips on the outer side to further safeguard against passage of the rays. The film strip is 2⅜ inches wide, affording ample coverage for the weld, as well as for the area immediately contiguous thereto, so that any welding operation which might affect the pipe is recorded. Following exposure of the film, it is processed in the darkroom on the half-track, and dried by blast from the radiator of the electric power unit. After being dried, the film may be handled and inspected by the pipeline management and the welder. Any defects found may be evaluated and steps taken to correct them before the pipe is cleaned and wrapped. The films are checked by the service company expert and then studied by pipe line supervisors and foremen. In this manner any possible misinterpretation of the film is avoided and the welds are either passed or rejected after review by more than a single operator.

Since the pig is reversible and travels equally as fast forward as backward, it may be used to check when traveling in either direction, the relative position of the indicating star wheel determining the location of the X-ray tube and consequent ray concentration.

In contrast to the coupon method, in

engines deliver
l pipeline system



TABULATION OF BUDA MODELS IN SYSTEM

Model No.	Usable HP*	No. in System	Total HP
HP-217	26	57	1,482
HP-298	35	3	105
FRH	50	19	950
HP-326	40	147	5,880
K-428	52	119	6,188
L-525	60	5	300
M-766	90	10	900
JL-877	75	5	375
MO-893	107	17	1,819
6DH-909	110	2	220
6DC-1879+	150	1	150
PCD-1879+	150	3	450
PHD-1879+	150	4	600
PC-1879	153	9	1,377
		401	20,796 HP

* for pipeline pumping
\+ Diesels operating on crude oil

BUDA

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Butane • Natural Gas
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BO-6

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FIGURE 4 (Left). At the weld, the sensitized film, carried in a rubber sheath between a stainless steel ribbon and a lead strip, is wrapped around the weld, with numerical or other identification to assist in identification later. The actual X-ray exposure is of 2½-minute duration, the X-ray being controlled by a triple set unit on the panel so that the ray is active only while a pushbutton is depressed.

FIGURE 5 (Right). At the end of a run the unit is reversed, moving by power back through the pipe to the cradle, where it is nested, and then swung back to the two curved supports at the driver's right and strapped into place for cross-country travel. The hand winch at the right controls lift and travel of the cradle support along the jib, which swings a 360-degree circle for quick spotting of the unit.

which the soundness of an entire weld is based on the destructive testing of a narrow strip—rarely more than two inches in width—cut across a weld, the X-ray system provides a record of weld construction around the entire circumference of the pipe. Thus, in the case of 26-inch pipe, the X-ray has more than 40 times the chance of detecting a faulty weld than has the coupon, as relative lengths of inspection record are as 2 is to 84.

Travel time of the pig in the line may be regulated by the operator at the rheostat. In 26-inch pipe the time to traverse an average joint varies from one minute eight seconds to one minute 10 seconds, enabling a stop watch to be used to check against the indication of the spotting light on the control panel. Feed of the power cable from the commutator reel is automatic, the pig pulling the wire after it. For the return trip the reel is turned by hand, keeping a slight tension on the cable to avoid fouling in the line by overrunning it with the pig.

Reel and control panel are light enough to be handled by one man, the reel being trundled on the rims until it reaches the desired location at the end of the section to be tested. Rotation of the supporting rack provides a base for the reel and also raises the rims off the ground to permit free rotation. All connections between power plant, panel, and pig are made through special weathertight separable socket connections and the operation of the inspection device is independent of weather and climatic conditions.

Personnel Requirements

Two men form the inspection crew and combine to perform the various duties involved in the job. While one man operates the rheostat and controls the motion of the pig within the pipe, the other distributes the film carriers along the line, wrapping and tying each in place at the welds previously selected as the ones to be X-rayed. On the return trip the exposed films are collected and processed in the darkroom. This may be done while the other member of the crew is returning the pig to its cradle and preparing the equipment for shift down the line to the next section. Development of exposed film may be carried out by one crew member while the other moves the entire unit along the line to the next checking station. Welds to be X-rayed are selected by the pipeline welding foreman and are not chosen in any regular sequence. At least one weld per welder is X-rayed each day, one unit and crew being sufficient to provide adequate control over the welding of up to the maximum footage attainable by a welding spread. Where two or more spreads are working within a relatively short distance, travel of the unit between spreads provides inspection for both sets of welds without holding up the progress of the cleaning, priming, and wrapping gangs.

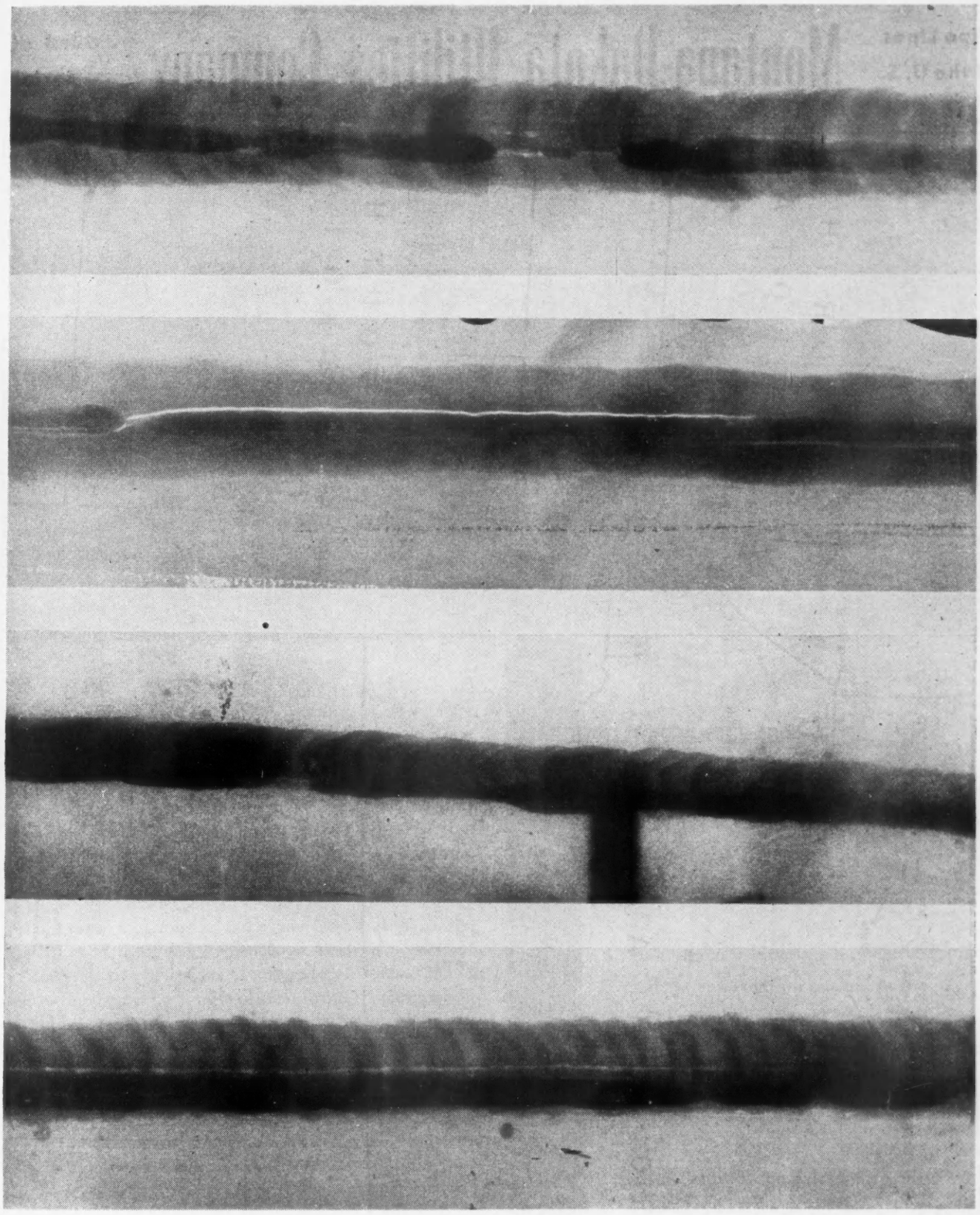
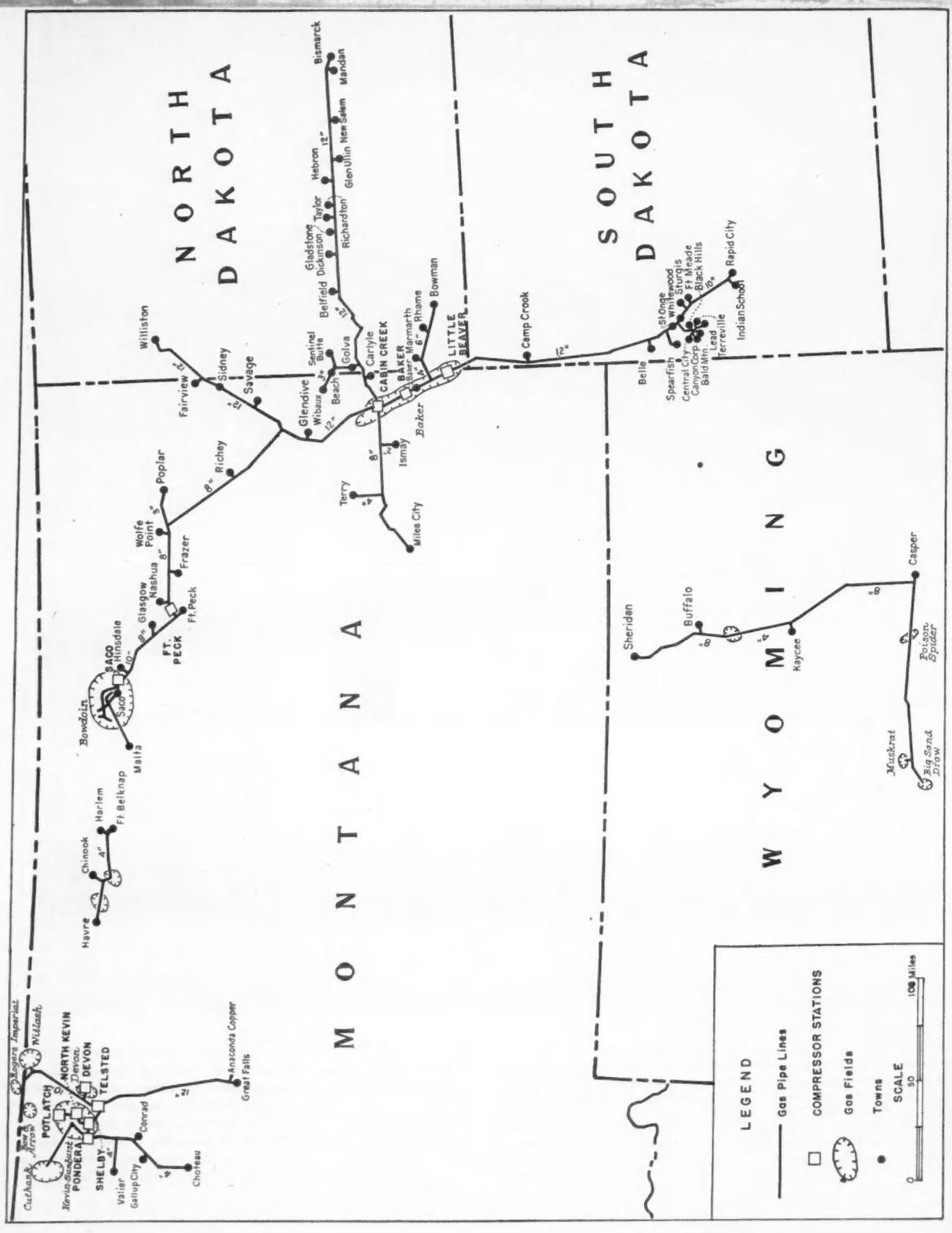


FIGURE 6. Sections of film from 26-inch line welds demonstrate the ease with which defects are identified and the quality of the weld determined. The reproductions are full size, showing the exact area of the weld and characteristics of each bead. The top illustration is from a weld in which the stringer bead was defective, almost an inch being missing near the center. Otherwise the weld is of proper width and with uniform filler and top beads. At upper center is shown a crack which extends within the weld for almost 4½ inches but which is not detectable by visual inspection. It is noted that the crack begins at a point where the stringer bead is missing. The strip in the lower center is from a good weld which, although slightly narrow, has good stringer, minimum undercutting, and uniform buildup. The wide band extending from the weld to the edge of the negative is the longitudinal weld in the pipe, and serves to orient the strip for comparison or checking. At the bottom a long slag inclusion at the filler bead is shown. At first glance much like a crack, the discontinuity and other characteristics are readily interpreted by an expert as slag left by incomplete cleaning of the weld between beads.

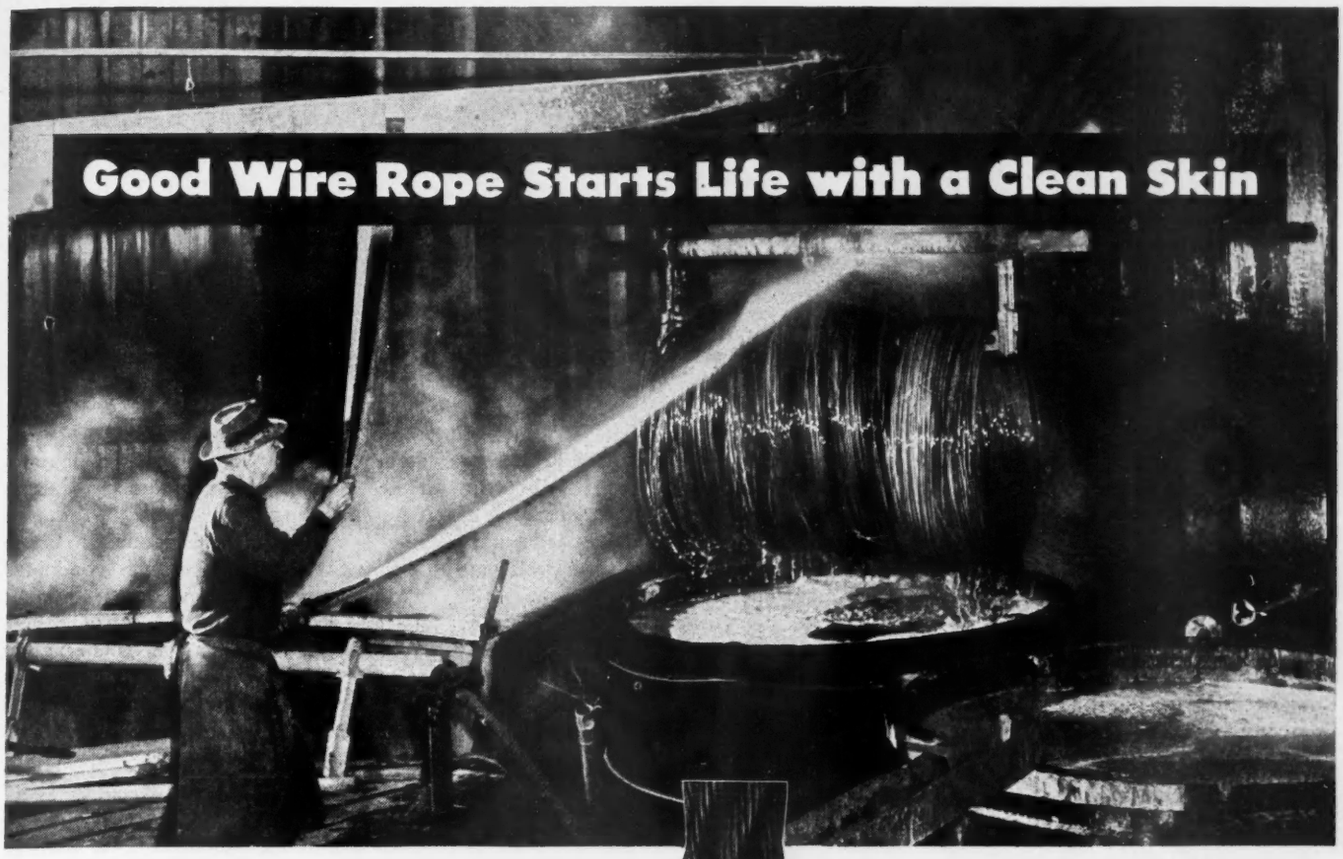
Pipe Lines of the U. S.

Montana-Dakota Utilities Company

53rd of a Series



Good Wire Rope Starts Life with a Clean Skin



Because scale is extremely detrimental to good wire drawing, every coil of rod that enters Wickwire's Rope Mill is thoroughly cleaned in a carefully prepared bath —with temperature thermostatically controlled and with acidity checked and recorded at frequent, regular intervals. Then the rods are sprayed with a high pressure hose to remove all traces of acid and scale, dipped in "bath salts," lime-coated, baked, and sent to be drawn into wire.

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Scale Traps in Sour Crude Service

By GEORGE L. CRAIN

IN 1939 was discovered in South Arkansas the first of eight fields from which sour crudes and distillates were to be produced. Interstate Oil Pipe Line Company, at that time Standard Oil Company of Louisiana, Pipe Line department, began to install an extensive gathering and trunk line system in this area to transport this crude to the Baton Rouge refinery of the then Standard Oil Company of Louisiana. By the end of 1945, when the last of these fields was brought in, Interstate had installed approximately 175 miles of various sizes of gathering lines and 50 high speed pumping units, as well as a 30,000-barrels-per-day main line station at Magnolia, Ark., and 15½ miles of eight-inch trunk line which tied into its existing system at Haynesville, La. These areas are shown in Figure 1.

In the fall of 1944, after experiencing a series of leaks and increased maintenance costs of pumps and tanks resulting from handling sour crude in the pipe line system from Magnolia, Ark., to Moore Station, a survey was conducted to determine what procedures could be adopted to reduce this type of corrosion. The composition of the deposits found in the pipe lines consisted primarily of iron sulfide, iron oxide, inert material and water, and the scale found on the roofs

SPECIAL PROVISION for trapping and removing line scale from a system before the oil reaches the pumps has been developed by one company following high plunger replacement due to damage when handling sour crudes. The author outlines the difficulties encountered, and presents an improved type of trap with readily removable filter element. This paper was read, substantially as here presented, before the International Petroleum Congress, at Tulsa, May 21.

About the Author

GEORGE L. CRAIN was graduated from Tulane University in 1942 with a degree in chemical engineering. After 3½ years service in the Navy, he was employed by Interstate Oil Pipe Line Company as district engineer in the Magnolia district. After one year he was transferred to the Shreveport office, where he is now employed under the supervision of S. R. Simmons, general superintendent of the Southern Division.

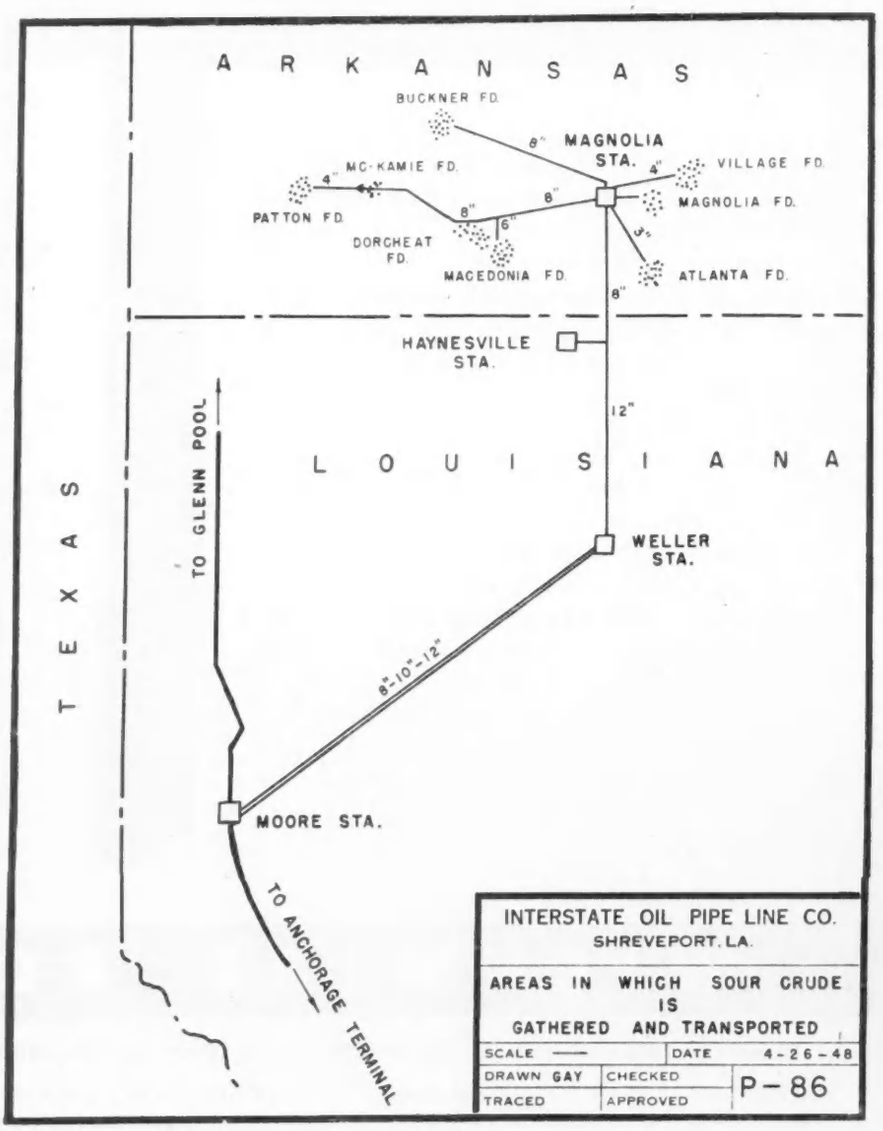

FIGURE 1

Stanolind Oil and Gas Company

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Gas cycling and maintenance operations at the Hastings Plant call for pressures varying from slight vacuum for rich or wet gas to 3,500 P.S.I. when dry gas is pumped into the wells for gas lift and conservation purposes.

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Metric Orifice Meters are effectively serving the exacting requirements of this plant at Hastings. The California Company's Lake St. John and Cranfield Plants; Shell's Sheridan Plant; Humble's Katy, Tom O'Connor, Anahauc, Clear Lake Plants, and others are demonstrating the suitability of Metric Orifice Meters for high pressure applications up to 5,000 P.S.I.

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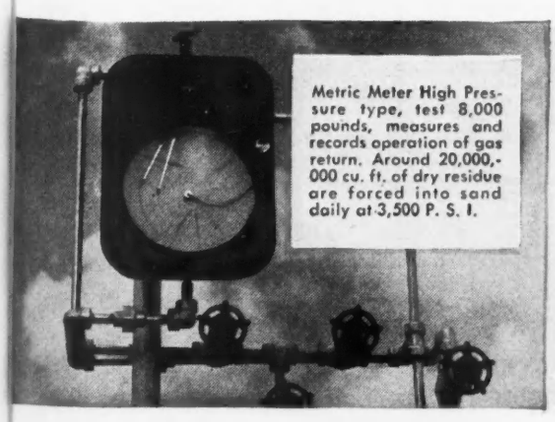

Metric Meter High Pressure type, test 8,000 pounds, measures and records operation of gas return. Around 20,000,000 cu. ft. of dry residue are forced into sand daily at 3,500 P. S. I.

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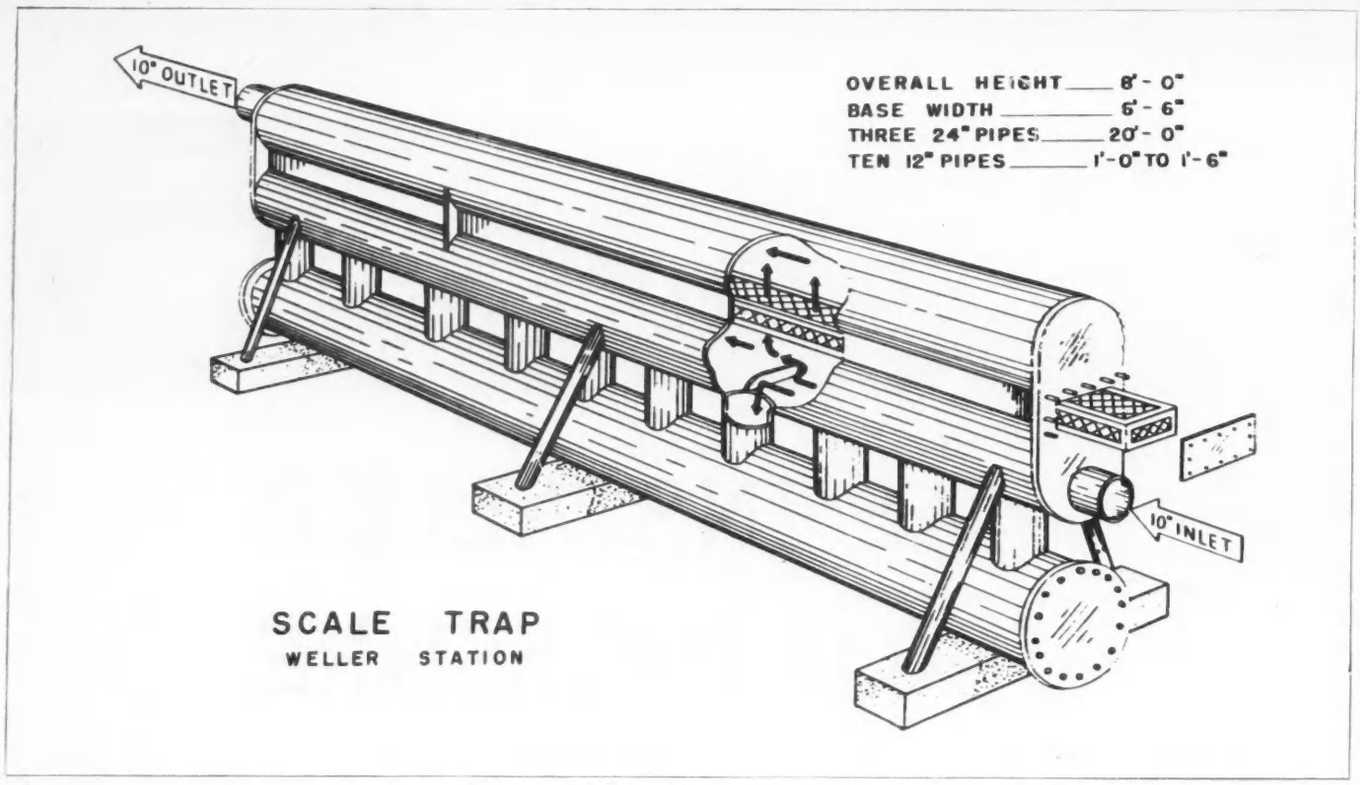


FIGURE 2

and bottoms of storage tanks to be iron sulfide with smaller quantities of iron oxide and free sulfur. Since iron sulfide is cathodic to iron in presence of H_2S dissolved in brine, ideal conditions for hydrogen sulfide corrosion existed throughout this system. In order to eliminate, as much as possible, the formation of scale in the trunk line system, an extensive scraper program was begun which moved the scale and brine from the lines into the tanks. However, when these tanks were pumped as low as possible, large quantities of the scale were picked up and passed through the pumps back into the line. Repairs to the pumps continued to increase at such a rate that it was decided to install a scale trap at Weller Station between the tanks and pump manifold. This station was chosen due to the large amount of costly repairs being made to the pumps.

Data were assembled from manufacturers of filtering equipment capable of handling 40,000 barrels of crude per day. None of these companies was constructing filters of this capacity at that time; therefore, the mechanical department designed a trap to meet the requirements (Figure 2). This trap was installed and placed in operation June 28, 1946. The cost of material and installation was approximately $3000. Immediately the repairs to the pumps at Weller Station dropped and approached those for sweet crude operations. Figure 3 shows the rise of plunger replacements from 1939 through the middle of 1946, then the decrease thereafter.

From January 1 to June 28, 1946, 25 plungers were replaced at a cost of $2300 and for the remainder of the year no replacements were required. Since the installation of this trap to January 1, 1948, seven plungers have been replaced, and indications are that plunger replacements will become stabilized at this figure.

Filter Media

Tests were conducted as to the best filter media to use. Rock wool, fiber glass, jute and cotton bagging, cotton waste and rags were tried either individually or in combinations. It has been concluded that the most efficient and economical medium to date consists of six to eight layers of jute bagging with a one-inch layer of cotton waste. All heavy materials and an estimated 60 percent of finely divided materials are separated within the trap. Eighteen thousand pounds of scale and 150 barrels of brine have been removed thus far by this trap.

Because of the good results obtained

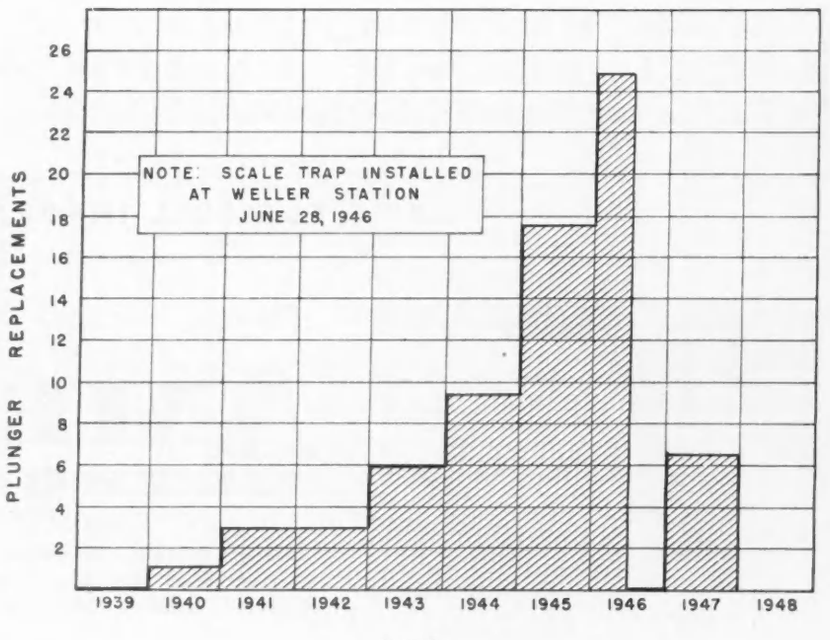


FIGURE 3

from the installation at Weller Station, the company decided to install similar traps at Magnolia Station on both incoming lines from the various fields and station suction lines. This installation was completed in May, 1947, at a cost of $17,460. A sketch of the sediment trap installation at Magnolia Station is shown in Figure 4.

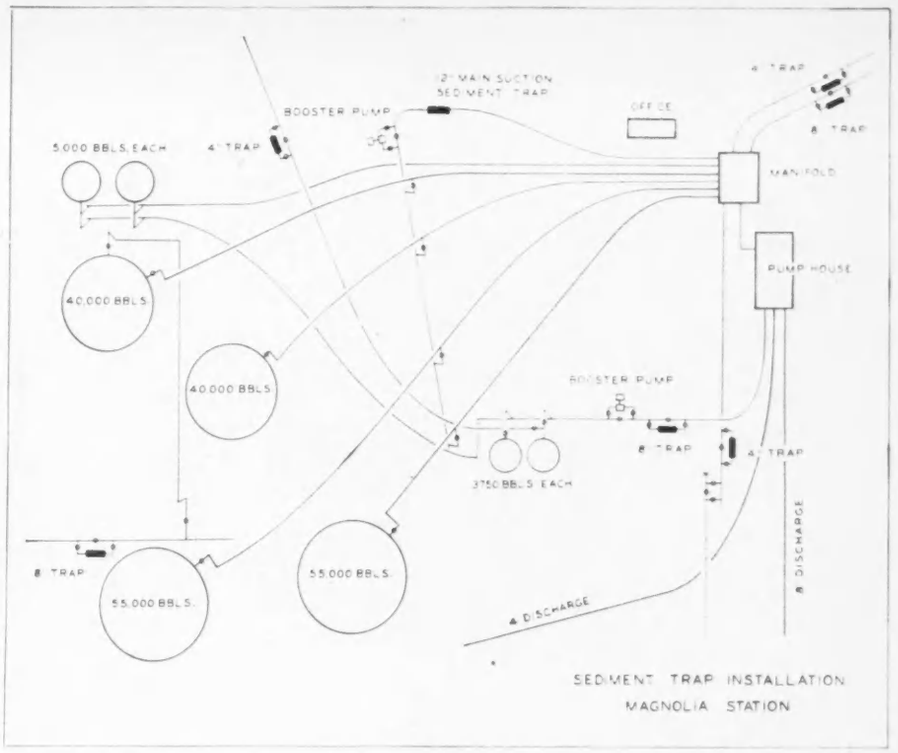


FIGURE 4

Trap's Defects

The trap installed at Weller Station has several defects, especially the weakness of the junction between the channel beam and pipe wall due to the difference in thickness of the metal and the small filter area. Consequently, the traps for Magnolia Station were redesigned and improved, as illustrated in Figure 6. This design has become standardized and will be used in all future installations. On the main suction line a 30-inch diameter single barrel trap was installed, capable of handling an excess of 30,000 barrels per day. Due to the small difference in elevation between several tank bottoms and the station manifold, a low pressure-high volume centrifugal pump was installed to boost the crude through the trap. The cost of this installation was $5925. Normally, the pressure drop through the trap will vary from 1½ to three pounds per square inch, depending upon the compactness of the filter media. This scale trap is shown in Figure 5.

On the filling lines into Magnolia Station the capacity of the traps required was much less than that previously mentioned. Here single barrel traps similar in design to the one above, but smaller in capacity, were installed. These five traps cost approximately $7480 to construct and install. This type scale trap is pictured in Figure 7. A sketch of the trap appears in Figure 8.

To date, these traps have removed 8500 pounds of scale and paraffin from the crude, which is handled through Magnolia Station. All the scale which is removed in the traps on the suction lines here comes from the tanks and the station piping.

Moore Station Traps

At Moore Station, three large traps similar to the one at Magnolia Station, but larger in size due to the volume of crude to be handled, have been installed on the main suction lines. All these units are equipped with 50,000 barrels per day booster pumps and bypassing arrangements to allow the maximum flexibility in operations. These units were only recently placed in service and no data are

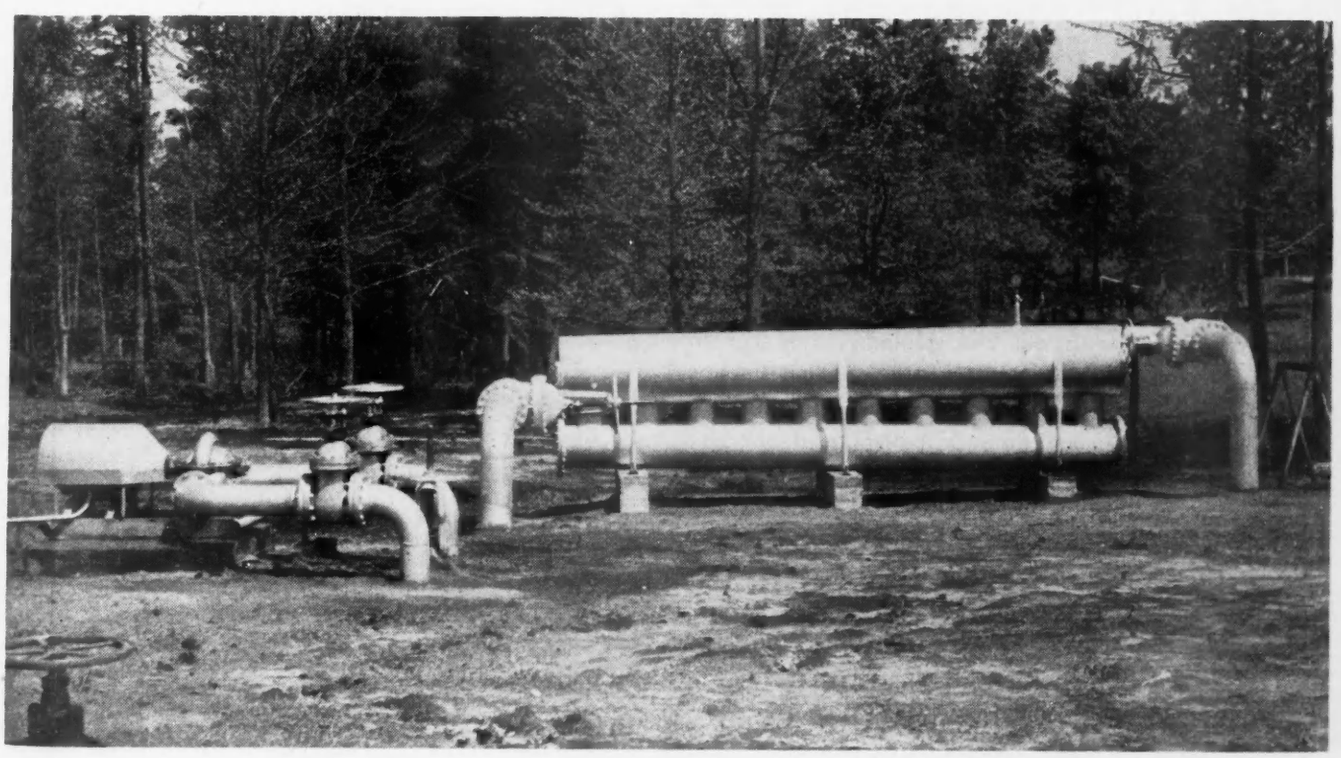


FIGURE 5

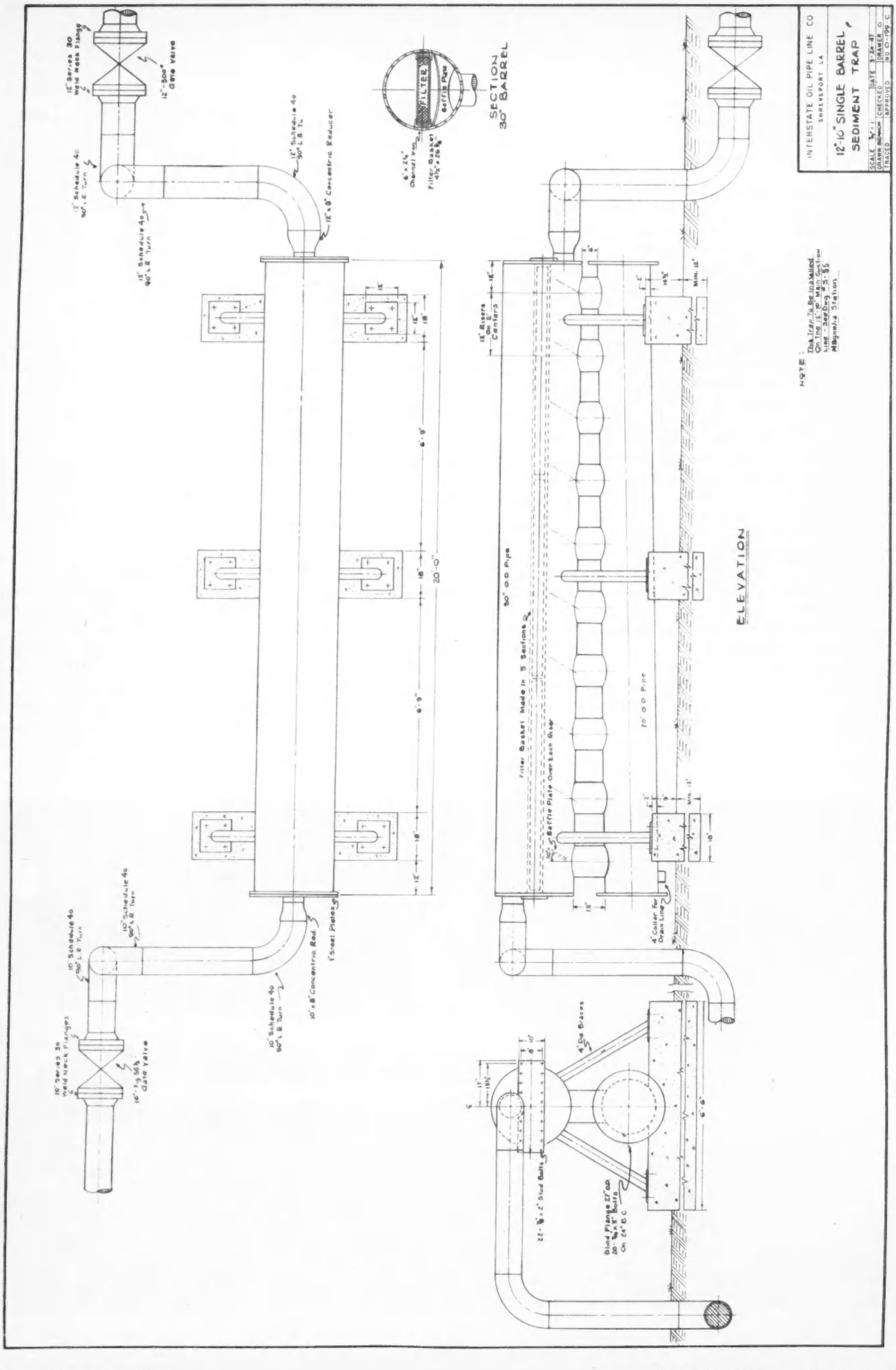
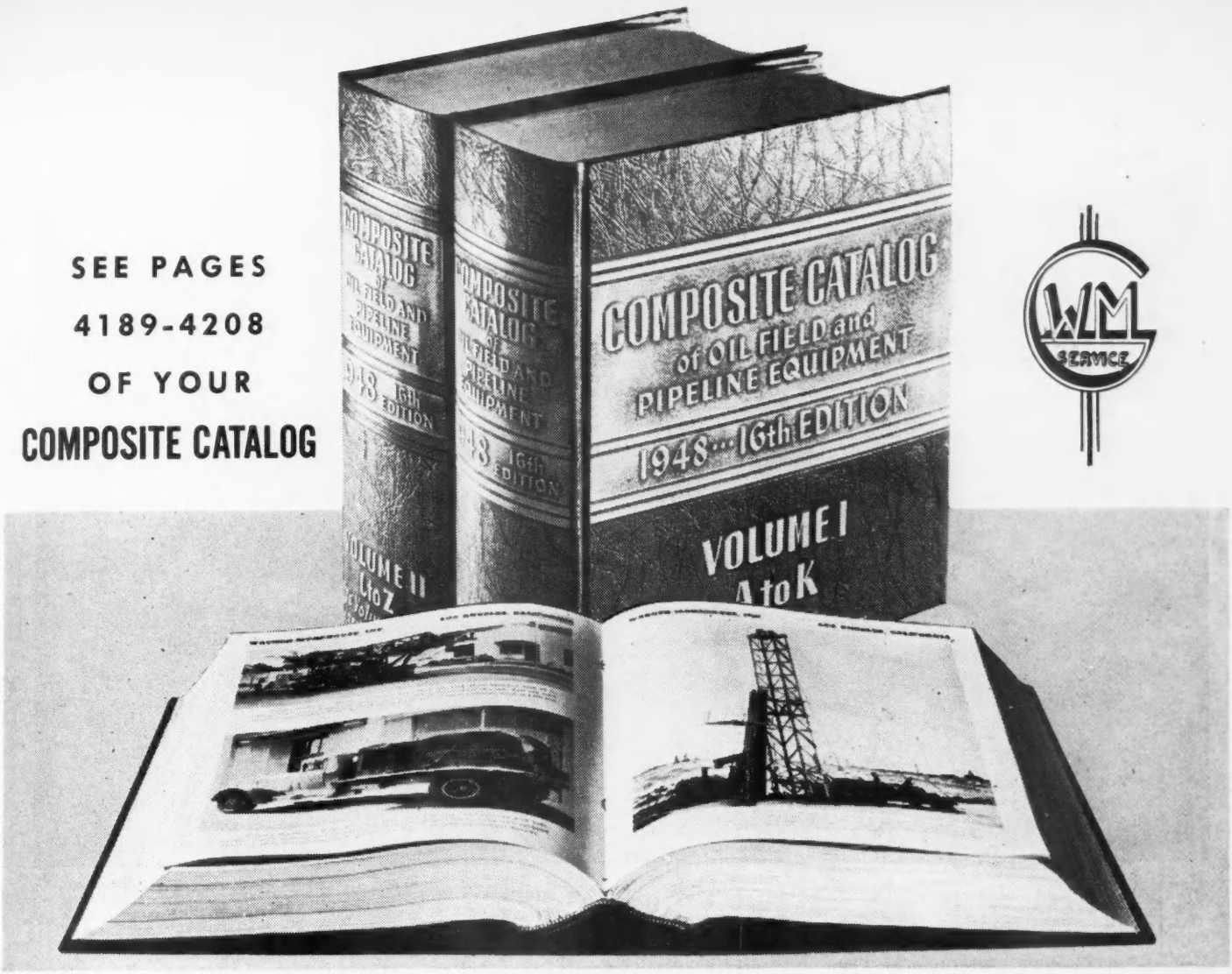

INTERSTATE OIL PIPE LINE CO
SHREVEPORT, LA.
12"-10" SINGLE BARREL SEDIMENT TRAP
SCALE 3/4"
DRAWN
CHECKED
DATE 3-20-47
DRAWER G
TRACED
APPROVED
NO D-199-C
ELEVATION
SECTION 30" BARREL
FILTER
Baffle Plate
Filter Basket
Channel Iron
12" Series 30 Weld Neck Flange
12"-300# Gate Valve
12" Schedule 40 90° L.R. Turn
12"x8" Concentric Reducer
8" Schedule 40 90° L.R. Turn
10" Schedule 40 90° L.R. Turn
10"x8" Concentric Red.
8" Schedule 40 90° L.R. Turn
10" Series 30 Weld Neck Flanges
10"-Fig 606 Gate Valve
30" O.D. Pipe
20" O.D. Pipe
Filter Basket Made in 3 Sections
Baffle Plate Over Each Riser
18" Risers On 8' Centers
4" Collar for Drain Line
4" Dia Braces
Blind Flange 27" OD
20-¾"x4" Bolts
On 24" B.C.
22-⅞"x4" Stud Bolts
20'-0"
MIN. 12"
MIN. 18"
NOTE:
This Trap To Be Installed On The 12"-10" Main Section Line - Sec 8 Twp 19 S - R 5 E Magnolia Station

FIGURE 6

SEE PAGES
4189-4208
OF YOUR
COMPOSITE CATALOG



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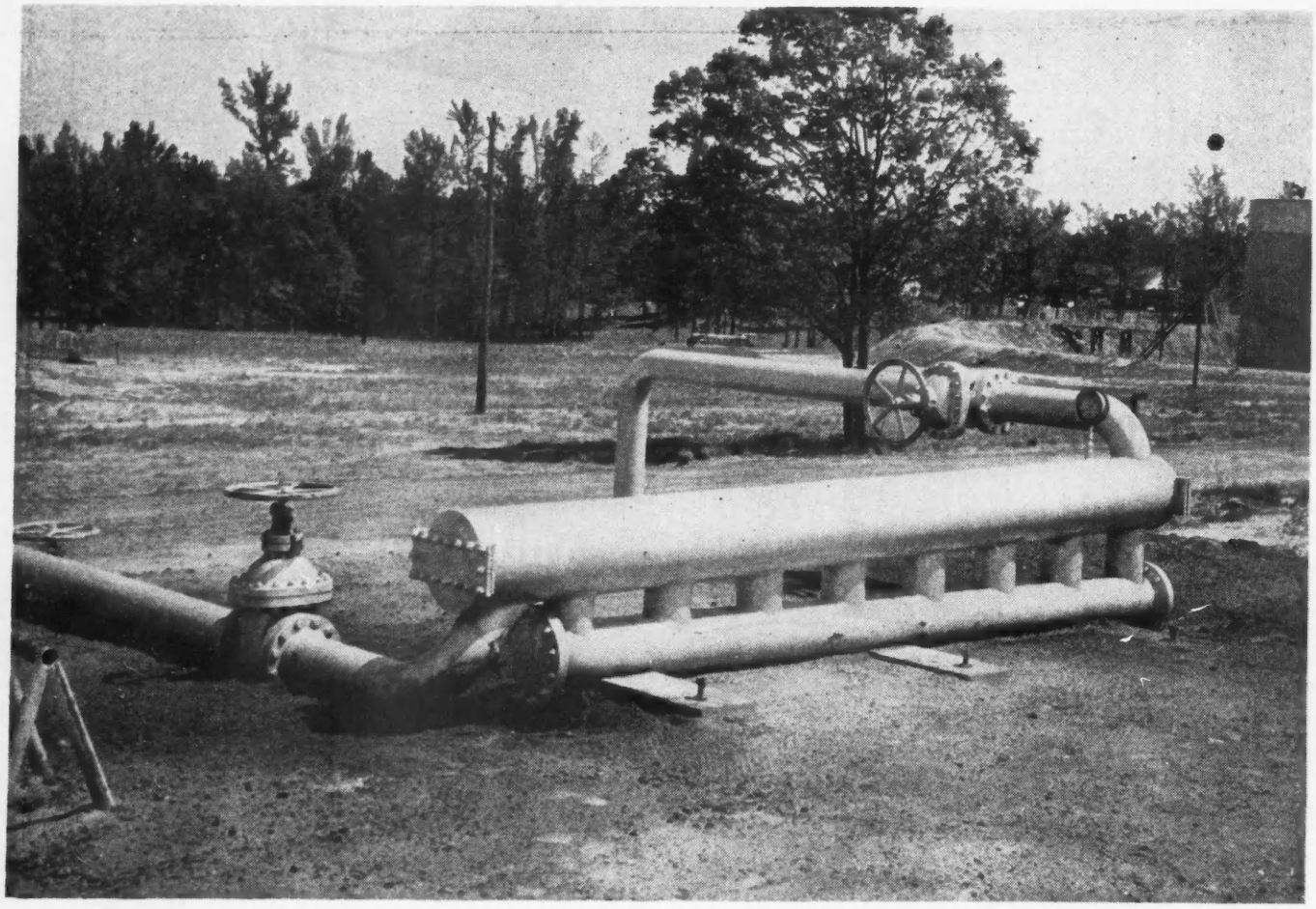


FIGURE 7

available as to their performance. The complete cost of this installation was $29,604.

Other Improvements

As each of the above stations operates at capacity each day, the elimination of down time is essential. Therefore, each trap is equipped with a bypassing arrangement which is used during time of cleaning or repairs. On large traps the cleaning interval varies from four to six weeks, provided the pressure drop does not become excessive, whereas on the smaller ones this interval may run as high as eight to ten weeks.

In addition to the improvements of the design of these traps, several operational improvements have also been made. One of the most important has been the elimination of vibration within the trap due to surges resulting from large reciprocating pumps. This has been accomplished by installing surge chambers between the trap and the pump manifold. For determining pressure drops across the filter media, only one gauge is used. This allows the pressure drop to be determined accurately since all possibility of error in gauge calibration is cancelled. Lids for the wire baskets which hold the filter media originally were bolted down. After several weeks of operation these bolts became tightened and considerable effort and time were necessary to remove these lids. This has been modified and now the lids are slid in place and the time for removal reduced to a minimum.

Although we have made considerable advance in design and operation of our traps there are still several items pertaining to them which we are continuously attempting to improve. The baskets which hold the filter media are made of two-inch angle iron, and ¾-inch mesh 12-gauge wire. In sour crude the service life is only two to three months.

It is planned to install an aluminum basket; also, there is the possibility of using protective coatings over iron mesh. Possibly one or the other will be satisfactory. Efforts to obtain new materials for filter media are continuing as well as an improved method for evaluating them.

Since these fields in south Arkansas were discovered, the majority of the Interstate's Southern division pipe line system has become affected with internal corrosion. As mentioned previously, the most affected area lies between Magnolia and Moore stations, but as various blends of sour crude are pumped both north and south from Moore Station, this system has also become affected. Due to the delivery requirements of Interstate Oil Pipe Line Company, 1043 miles of trunk line varying in size from eight to 12 inches, 52 large storage tanks, 11 trunk line stations and gathering systems in eight sour crude fields, have become exposed to sour crude. The cost of repairs due to internal corrosion in this system has been excessive during the past years, and the costs are increasing annually.

Interstate will soon have 12 scale traps operating in the sour crude system from Magnolia to Shreveport. By removing the scale formed in the lease tanks and gathering systems of the sour crude fields at Magnolia Station, and eliminating the scale formed in storage tanks at each station, pipe line facilities are protected and one of the main contributors to hydrogen sulfide corrosion eliminated. Although it is difficult to evaluate the benefits being derived from the installation of scale traps other than a reduction in pump maintenance, these traps are a good investment and it is planned to install them whenever and wherever conditions warrant.

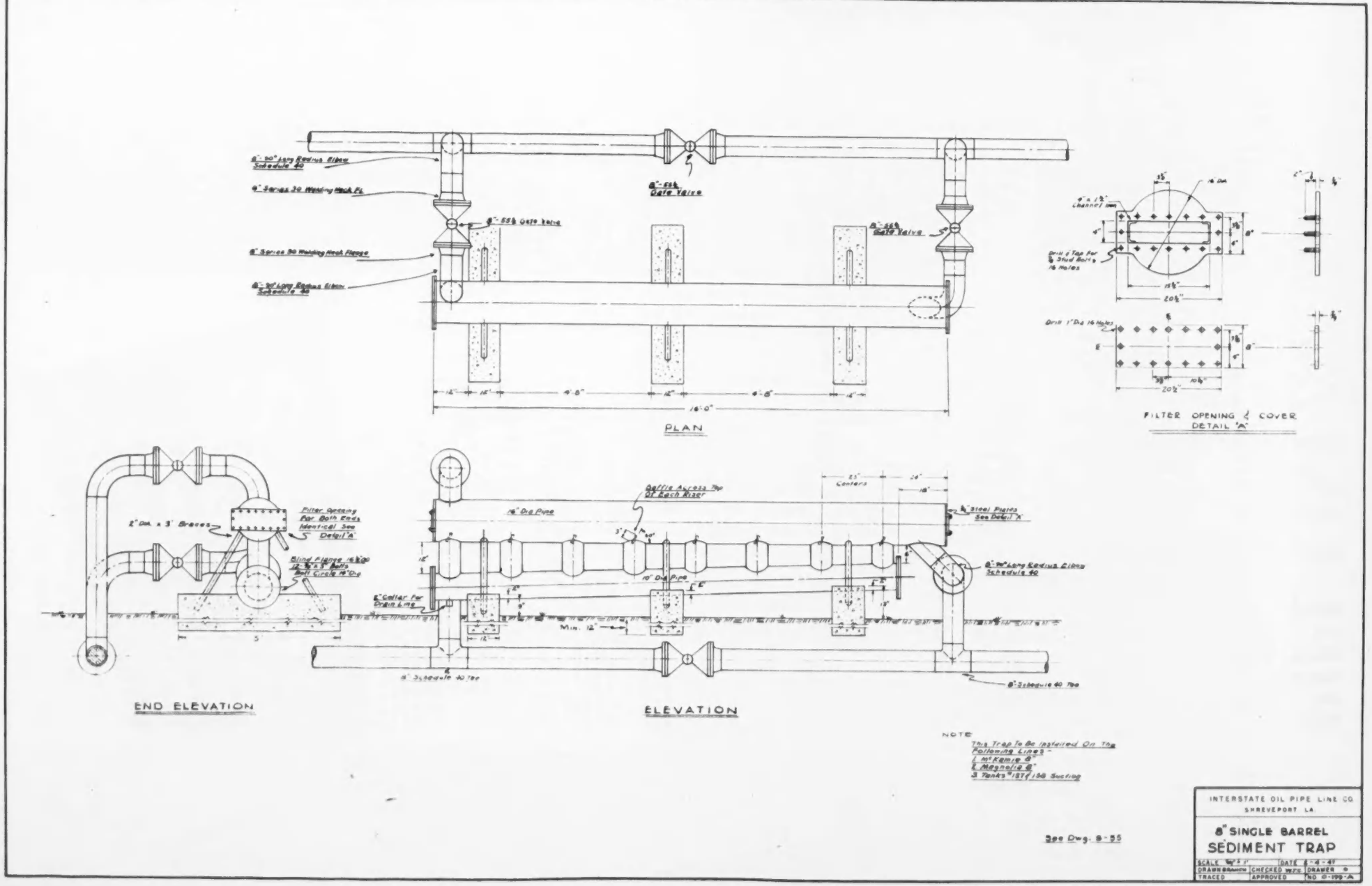
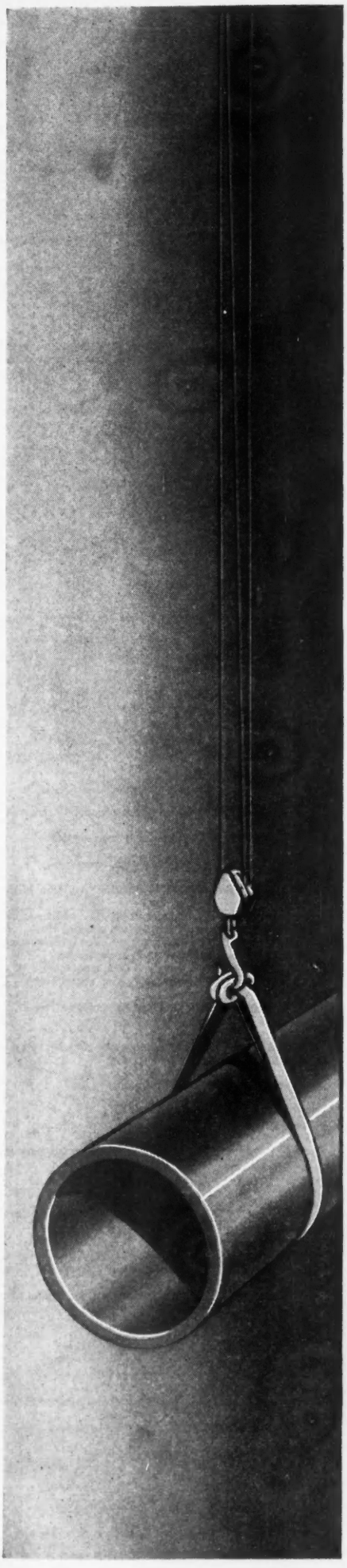

PLAN
FILTER OPENING & COVER DETAIL 'A'
END ELEVATION
ELEVATION
NOTE
This Trap To Be Installed On The Following Lines -
L Mc Kamie @
L Magnolia @
3 Tanks @ 15T & 15B Sucrlng
See Dwg. B-35
INTERSTATE OIL PIPE LINE CO.
SHREVEPORT, LA.
8" SINGLE BARREL
SEDIMENT TRAP
SCALE 3/4" = 1'
DATE 8-4-41
DRAWN BRANNON
CHECKED
TRACED
APPROVED
DRAWER 0
NO. B-199-A

FIGURE 8

PIPE LINE *Construction*

COMPANY	Origin and Terminus	Length (Miles)	Pipe Size (Inches)	Daily Capacity (Bbls. Cu. Ft.)	REMARKS
CRUDE OIL LINES					
Arabian American Oil Co.	Abqaiq field to Qatif Jct., Saudi Arabia	43	30 & 31	.....	Construction completed by company crews. Abu Hadriya line will eventually be part of TAPline, but meanwhile will take oil to Persian Gulf.
	Qatif Jct. to Ras Tanura refinery	22	20 & 22	.....	
	Abu Hadriya to Qatif Jct.	82	30 & 31	.....	
British-American Oil Prod. Co.	Tri-Cities field, Henderson Co., East Texas, to Cotton Belt Railroad	5	2	2,000	Completed by Williams Construction Co., Selman, Texas.
Buckeye Pipe Line Co.	Lima to Toledo, Ohio	80	22	140,000	Contract to be awarded in August or September, construction completed during 1948.
Humble Pipe Line Co.	Albany station to Putnam station, Shackelford Co., West Texas	18	4	.....	Two 9-mile lines dismantled and replaced with 1 6-inch line; also dismantled: 2 miles 4-inch. Completed by Royce L. Boyd, Cisco, Texas.
	Junction at Throckmorton-Stephens county border to Snowden and Marris fields, North Texas	¾	4	.....	Royce L. Boyd, Cisco, Texas, completed project.
		1	3		
		2	2½		
	Talco field gathering lines, East Texas	11	8	.....	J. R. Stewart Construction Co., Houston, completing early August.
Hunt Oil Co.	Near Lisbon, La.	2⅜	8	.....	Fowler Bros., Cotton Valley, La., completed.
Iraq Petroleum Co.	Kirkuk field, Iraq. to Mediterranean via Homs, Syria	530	30	275,000	Construction of third north line from Kirkuk planned for 1951. May supplant or supplement planned 16-inch.
Kuwait Oil Co.	Burghan field and gathering lines, Kuwait	.....	20 & 22	.....	Expands present 12-inch line to tank farm.
	From tank farm to loading jetty	5	12	.....	Construction of company's lines to be completed June, 1949. Bechtel International Corp., San Francisco, contractor.
Magnolia Pipe Line Co.	Loop near Mitchell, Ill.	4	12	.....	Sheehan Pipe Line Construction Co., Tulsa, completing.
	Near Yale, Okla.	20	2-8	.....	Reclaim and recondition job started by Western States Construction Co., Oklahoma City.
	Near Meeker, Okla.	26	8	.....	Takeup job completed by Bishop and Lock Construction Co., Dallas.
Ohio Oil Co.	Stoy, Ill., to Robinson, Ill.	6	10	.....	Sheehan Pipe Line Construction Co., Tulsa, has work under way.
Phillips Petroleum Co.	Near Andrews, West Texas	8½	8-24	.....	McVean & Roberts, Odessa, Texas, completed construction.
	Near Oklahoma City, Okla.	10	3-24	.....	Reclaim job under way by Western States Construction Co., Oklahoma City.
Richfield Oil Corp.	From Lake station to Leutholz Lease, Calif., in Midway-Sunset area, San Joaquin Valley	5	5		Completed by Pacific Pipeline & Engineers, Ltd., Los Angeles.
	Extension beyond Leutholz Lease	14	6	10,000	Richfield and Pacific Pipeline & Engineers constructing.
	Connection with 16-inch to Cuyama field, Cuyama Valley	22	6		Key Contractors, Santa Fe Springs, Calif., constructing. Projects scheduled to complete August 1.
Rocky Mt. Pipe Line Co.	Denver, Colo., to point 25 miles north of Cheyenne, Wyo.	118	10	26,500	Completed and in operation. R. H. Fulton & Co., Lubbock, Texas, Osage Construction Co., Winfield, Kans., and Goldernstern & Stolper, Ponca City, Okla., contractors.
		30	8		
Shell Pipe Line Corp.	Wheeler field to Wink station, West Texas	21	10	.....	Smith Contracting Corp., Ft. Worth, starting August 1.
	Chain of Rocks Canal, Wood River, Ill.	5	8, 10, 16	.....	Relocation of lines started by Midwestern Constructors, Tulsa.
Stanolind Pipe Line Co.	Wamsutter station, Sweetwater Co., to Sinclair station No. 3. Carbon Co., Wyo.	56	8	8,100	C. L. Rogers Construction Co. Wichita Falls, Texas has work under way, may complete September 15.
	Beck to Brady, Neb.				Looping on Casper, Wyo.-Freeman, Mo. line awarded to R. H Fulton Co., Lubbock, Texas, to complete Sept. 15. Capacity Casper to Washington 51,000 bbls. per day; Washington to Freeman 70,000 bbls. per day.
	Cozad to Lexington, Neb.	64	16		
	Broadwater to Northport, Neb.		12		
	Minature to Mitchell, Neb.	¼			
	Beck to Brady, Neb.				Contract for takeup and reconditioning of loops on Casper to Freeman line awarded to Jayhawk Construction Co., Great Bend, Kans. To complete Oct. 2.
	Cozad to Lexington, Neb.	51	10	.....	
	Broadwater to Northport, Neb.		12		
	Minature to Mitchell, Neb.	7½			
	East Ft. Madison to Lomax, Ill.				Trojan Construction Co., Oklahoma City, completing July 30, takeup and reconditioning of loops on Drumright, Okla., to Manhattan, Ill., line.
	Laura to Edelstien, Ill.	14	10	.....	
	Ransom to Mason, Ill.	27	8		
Sun Oil Co.	Delhi field gathering system, La.	70	2-26	.....	Completed by Fowler Bros., Cotton Valley, La.
The Texas Pipe Line Co.	Port Neches, Texas Gulf Coast	10	20	.....	Latex Construction Co., Houston, completing end of July
		7½	12		
		2	8 & 10		
The Texas Pipe Line Co., Shell Pipe Line Corp., Empire Pipe Line Co., Sinclair Pipe Line Co.	Midland, West Texas, to Wichita Falls, North Texas	253	22	105,000	Second spread of Basin Pipe Line System (Jal, N.M.-Cushing, Okla.) completed by Latex Construction Co., Houston. Crude being moved from Wichita Falls by rail until last section of line laid into Cushing.
	Pump station, Wink, Texas	.....	.....	.....	Contract awarded to Brown Lane Co., Amarillo, Texas.
	Pump station, Wichita Falls, Texas	.....	.....	.....	Contract awarded to Graver Construction Co., Houston.
	Wichita Falls to Cushing, Okla.	175	24	.....	Bids taken mid-July. for third and final spread.
Texas-Western Oil Lines, Inc.	Midland, West Texas, to Los Angeles area, Calif.	900	20 or 24	150,000	Company forming to plan project for 1949.
Toronto Pipe Line Co.	Tri-Cities field, East Texas	5	2	2,000	Completed by Williams Welding Co., Solomon City, Texas.
SALT WATER DISPOSAL LINES					
Sun Oil Co.	Kimball Lake field, Newaygo Co., Mich.	3	3		Somerville Construction Co., Ada, Mich., completing end of July.
		2	4		
		1	6		



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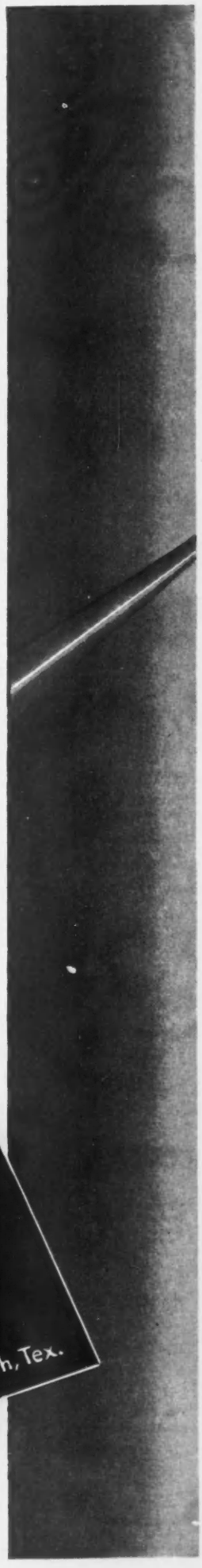

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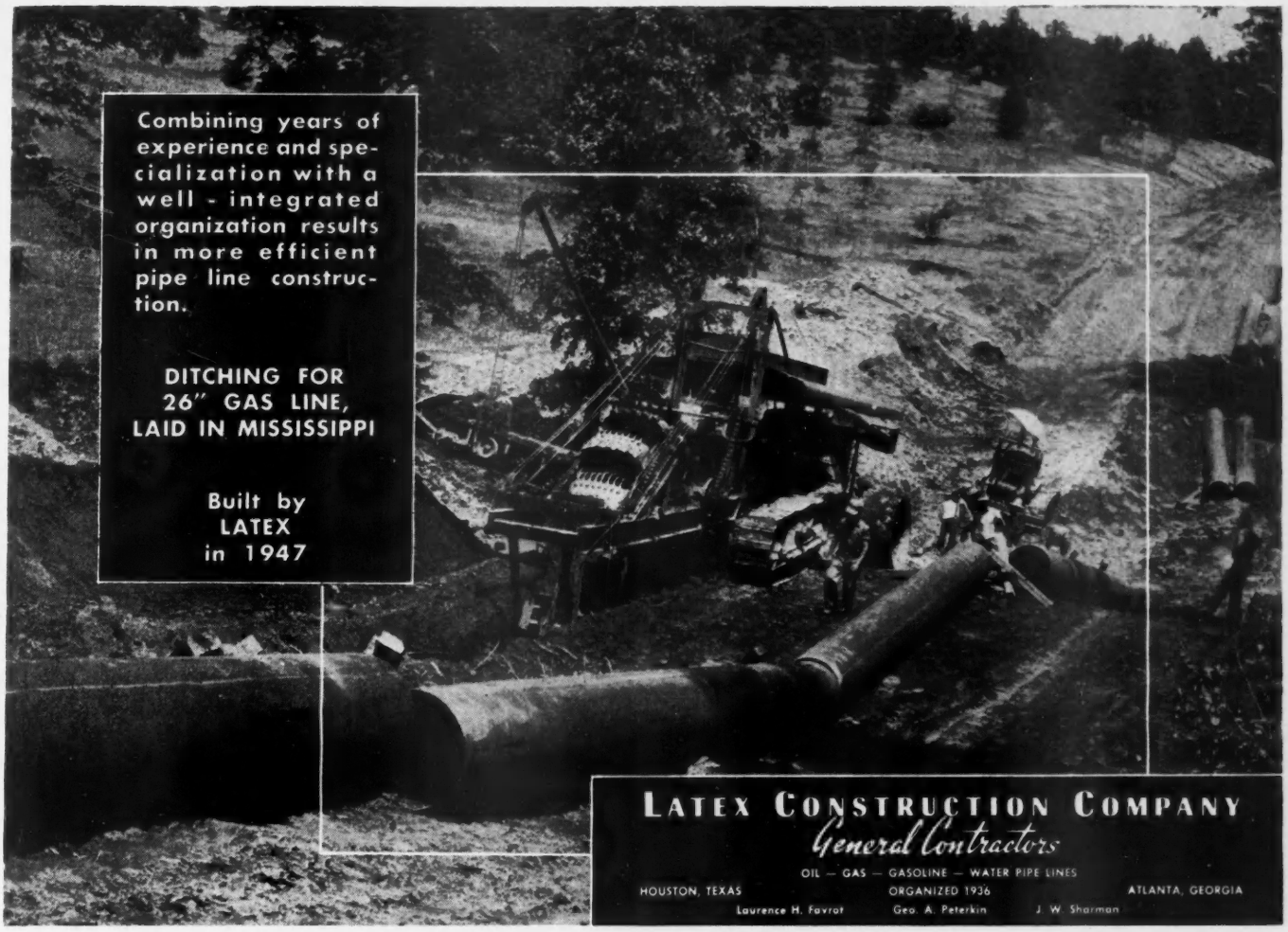
Pipe line Construction—(Continued)

COMPANY	Origin and Terminus	Length (Miles)	Pipe Size (Inches)	Daily Capacity (Bbls. Cu. Ft.)	REMARKS
PRODUCTS LINES					
Claiborne Gasoline Co.	Lisbon, La., to El Dorado, Ark.	32	4	.....	Completed by Fowler Bros., Cotton Valley, La.
Frontier Fuel Oil Corp.	Lines radiating out of Buffalo, N.Y.	4½	6	.....	Sheehan Pipe Line Co., Tulsa, completing replacement of 5 old lines.
Sinclair Refining Co.	Ft. Worth to point north, North Texas	50	8	.....	Takeup job being completed in August by Latex Construction Co.
Socony-Vacuum Oil Co.	Portland to Bangor, Maine	124	6	.....	Construction begun by Associated Contractors & Engineers, Houston, to complete in December.
The Texas Pipe Line Co. and Magnolia Pipe Line Co.	Hearne to Dallas, North Texas Dallas to Ft. Worth	146 26	10 8	30,000	Completes joint products system from Beaumont via Hearne to Dallas-Ft. Worth with laterals from Hearne to Austin and San Marcos. Associated Contractors & Engineers, Latex Construction Co., Smith Contracting Co., Contractors.
NATURAL GAS LINES					
Byrd Frost, Inc., et al	Point south of Farmington, N.M. to Salt Lake City, Utah Salt Lake City to San Francisco, Calif.	455 855	26 26	450 mln.	Line from San Juan Basin tentatively planned, possibly expanded to Seattle, Wash., upon development of additional reserves. Line to be convertibile to crude or products when constructed.
Chicago District Pipe Line Co.	Loop on Calumet line from Joliet to southern Chicago city limits, Ill.	41	24	.....	Application approved by FPC. Existing line will be repaired and rehabilitated.
Cities Service Gas Co.	Near Olathe, Kans. Near Oklahoma City, Okla. Extension on Olathe, Kans., line in Missouri	49¼ 2½ 7	26 8 26	.....	Completed by Midwestern Constructors, Tulsa. Completed by Western States Construction Co., Oklahoma City. Midwestern Constructors, Tulsa, completing August 1.
Colorado-Wyoming Gas Co.	Mesa (Denver), Adams Co., Colo., to Cheyenne, Wyo.	90 11	8 16	20 mln.	Completed by Pacific Pipeline & Engineers, Los Angeles.
Dow Chemical Co.	Clare to Midland, Mich.	30	6	.....	Reconditioning under way by Somerville Construction Co., Ada, Mich.
East Tennessee Natural Gas Co.	Connection with TGT line to Bristol, Tenn.	319	22, 16, 8, 6	100 mln.	Application to FPC.
El Paso Natural Gas Co.	From Lea County, N.M., to point on Colorado River, near Blythe, Calif. Benedum field, Upton Co., West Texas, to Keystone station Point on present 26-inch to vicinity of Needles, Calif. Main line looping Ft. Huchuaca to Nogales, Ariz. Quartsite to Yuma, Ariz. Wilcox to Safford, Ariz. Safford to Miami, Ariz. Plant No. 1, near Jal to Eunice plant, N.M. Eunice, N.M. to Dumas, Texas, Panhandle	450 95 191 56 270 75 74 50 45 251	30 24 26 & 30 30 4-10 5 8 10 30 24	180 mln. 300 ml. 100 mln.	Additional line to parallel existing 26-inch carrier. Application to FPC. Amended Application to FPC in July. Included 5300 additional HP., treating and dehydration plants, and gathering lines in Permian Basin. Lines under construction by company crews.
Empire Southern Gas Co.	Gathering lines Shafter Lake field, West Texas	2 2	4 2	.....	Completed end of July.
Humble Oil & Refining Co., Gas Department	From Mayes Pasture via Jackson Pasture to Double Bayou, Texas Gulf Coast	10⅜	8	.....	Contract awarded to Latex Construction Co., Houston.
Magnolia Petroleum Co.	Gathering system near Hugoton, Kans.	185	4-24	.....	R. H. Fulton & Co., Lubbock, Texas, completed.
Manufacturers Light & Heat Co.	Gathering system near Cameron, W. Va.	35	4-14	.....	Britton Contracting Co., Ft. Worth, completing.
National Cylinder Gas Co.	Detroit, Mich.	1	6	.....	Completed by Somerville Construction Co., Ada, Mich.
Northern Natural Gas Co.	Loops along existing line Gathering line north of Sublette station, Kans. Branch line to Dodge City, Kans. From Sublette station to point northwest Loop from Clifton, Kans. to point north	28½ 17 6 17½ 14 11	24 20 8 6 20 24	40 mln.	Application to FPC includes 8900 HP. additions to 5 compressor stations. Construction planned 1949. Brodie Construction Co., Hugoton, Kans. constructing. Brodie Construction Co. to start in September. R. H. Fulton & Co., Lubbock, Texas, completed. C. S Foreman Co., Kansas City, Mo., completing.
Ohio Fuel Gas Co.	Salt Creek storage project, Benton Co., Ohio	6⅛	10	.....	Midwestern Constructors, Tulsa, to complete July 31.
The Peoples Natural Gas Co.	Gamble-Hayden storage field, Allegheny Co. to Wall station, Pa. Point 1 mile east of Greensburg to vicinity of Latrobe, Pa.	3 6	12 16	.....	Williams Brothers Corp., Tulsa, to complete Mid-August. Williams Brothers Corp. completed.
Potomac Gas Co.	Point near Dranesville to point near Arlington, Va.	18	16	30 mln.	Application to FPC.
San Juan Pipe Line Co.	San Juan Basin, northwest N.M., to point in Mojave Co., Ariz.	451	26	152 mln.	Application to FPC.
Southern California Gas Co. and Pacific Lighting Corp.	Relocation work on Ridge Route, north of Castaic, Calif.	⅛ ⅛ ⅛	12 22 26	.....	Pacific Pipeline & Engineers, Los Angeles, handling project.
Southern California Gas Co. and Southern Counties Gas Co.	Point near Rivera, Calif., to vicinity of Pasadena, Calif.	18	30	.....	Application approved by FPC.
Tennessee Gas Transmission Co.	Main line loops Looping between El Campo, Texas and Natchitoches, La. Main line loops	156 210 207	30 30 & 31 30 & 31	60 mln.	Application to FPC. Contracts awarded to H. C. Price Construction Co., Bartlesville, Okla., and Bechtel Corp., San Francisco. Application to FPC to substitute for 217 miles of 26-inch loop line.
Texas Gas Transmission Corp.	Carthage gas field, East Texas, to TET station No. 16, near Middleton, Ohio Loop at Madisonville, Ky. to point near Evansville, Ind.	114 726 32	20 26 12	390 mln.	Application to FPC. Stone & Webster Engineering Corp. to supervise construction of pipelines and 10 compressor stations.
United Gas Pipe Line Co.	Loop from Kaufman County, North Texas, on main line Mineola station, Wood Co., to point in Van Zandt Co., North Texas Benton-Jackson line, Hinds Co., to Miss. Power & Light Co. plant near Jackson, Miss.	16 13 3⅜	18 18 12	.....	Completed by O. C. Whitaker Co., Ft. Worth. Loop completed by O. C. Whitaker Co. Completed by B. & M. Construction Co., Oklahoma City.
United Natural Gas Co.	Radiating out of point near Kane, Pa. Replacement of line in Elk County, Pa. From storage field to compressor station, Elk County From storage field to station, Jefferson County	20½ 19⅜ 64 20½ 29 4½	22 20 12 22 12 10 or 12	.....	Williams Brothers laying, takeup and relaying lines. Application approved by FPC. Replaces 12-inch pipe.
Warren Petroleum Co.	Gathering system at Taylor Corner field, near Wichita Falls, North Texas	41	.....	.....	Geo. W. Davis Construction Co. has work under way.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Built by LATEX in 1947
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General Contractors
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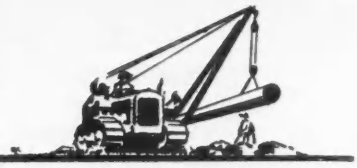
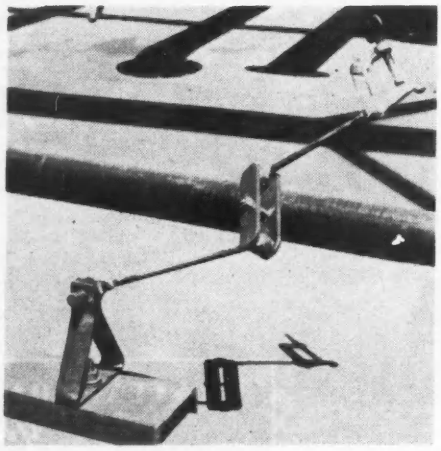


$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

HOW TO—Construct Device to Hold Small Parts for Lone Welder

When one welder is working alone, he frequently finds it necessary to weld a small part or a fitting to an assembly under construction. Such a job is awkward unless an assistant is nearby to position these pieces. To facilitate such work, one welder made a "third hand" or welder's aid to hold small parts exactly in any position desired until it could be tack-welded in place. Means of holding the work is provided by a modified "C" clamp with an extended lower leg. This clamp is supported by a half-inch steel rod brazed to the clamp. Opposite end of the rod is brazed to a steel ball salvaged from large bearings.



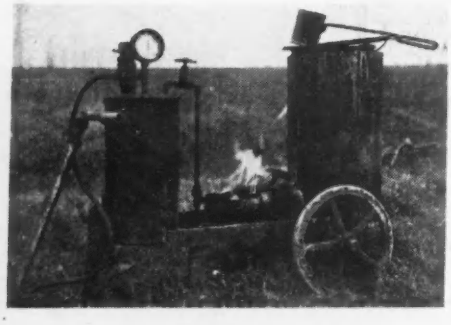
A short section of six-inch channel iron is used for the base, to which is bolted a triangular bracket. Apex of the bracket is bolted to an eye base of a second steel rod, the opposite end of which is also fitted with a steel ball.

The elbow or universal of the device is made from a two-bar clamp as shown, the inside surfaces of which are ground to fit the curvature of the balls. By screwing up on the clamp, any amount of rigidity may be obtained. The pair of ball joints form a flexible arm so that any position may be taken by the "C" clamp to hold small fittings against other parts to which it is to be welded. The device permits the welder complete freedom while performing the job without the aid of an assistant.

HOW TO—Make Dope Heater from Scrap Material

When coated and wrapped pipelines are laid, it is always necessary to have hot dope to cover the joints which are left bare of wrapping. This is especially true in the smaller sizes of pipe which are coated and wrapped before shipment to the field. One pipeline company made an efficient dope heater from scraps of material which can be found around any pipe yard.

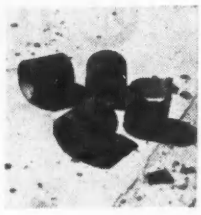
The fuel container shown in the illustration was made from a two-foot nipple of 12-inch pipe, and the heater and dope container were made from a 30-inch section of 16-inch pipe, with a false bottom so that the lower end has space for the burner. After fabrication, both sections are mounted on a two-wheeled cart which was converted from a pipe buggy. A two-inch nipple holds up one end so the assembly will set firmly on uneven ground.



In operation, the fuel tank is filled about ¾ full of kerosine or distillate fuel and about 50 pounds of pressure applied by means of a tire pump. The outlet line, which is connected to the top of the tank, runs to the bottom (to effectively drain the tank) and then to the firebox of the heater.

The ¼-inch fuel line makes a complete loop through the firebox where the fuel is preheated as it is jetted into the burner. Dope can be applied wherever and whenever needed by keeping this unit fired and near the line. The volume of fuel and the pressure system will keep the unit in operation for hours without constant attention.

HOW TO—Prevent Foreign Matter From Entering Small Pipe



A common hazard in the laying or repairing of lease gathering and lead lines is that of having rodents, rubbish or dirt get into the open ends of pipe, to cause unending grief after the line is completed and the system placed in operation. The production department of one company removes much of this uncertainty by providing, at the job site, a number of caps of various sizes with which unprotected, threaded pipe ends may be closed off temporarily while other parts of the line are being assembled and completed.

The caps are ordinary pipe couplings, to one end of which are welded discs of light steel plate or sheet. Good use may be made of collars which have injured threads on one end, but which still have one end in serviceable condition. Likewise, couplings having threads considered too loose for high pressure service may be employed. A small box full of various-size couplings of this type will take up little space in the field truck, but the benefits to be derived through their use will outweigh many times their initial cost or trouble in handling.

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PERMITS THE ECONOMICAL USE OF CATHODIC PROTECTION

Experience has demonstrated that Cathodic Protection can only be used economically when it is applied in connection with an electrically resistant protection system.

Barrett's Protection System consists of priming and coating with Barrett* Coal-tar Enamel and wrapping to resist soil stresses. The proved resistance of Barrett* Coal-tar Enamel to moisture absorption insures a continuous electrical insulation over long periods of time.

The stability of electrical resistance permits the minimum use of electrical energy and equipment now and in the future. The service records of Barrett* Coal-tar Enamels, used in all types of climatic and soil conditions, are a dependable guide to engineers who are today building corrosion-proof pipelines.

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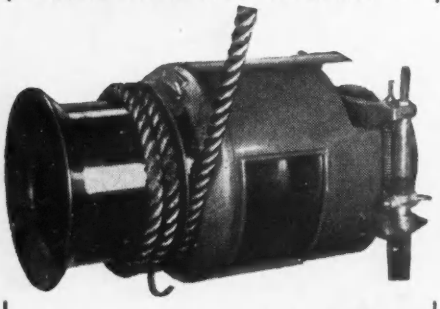

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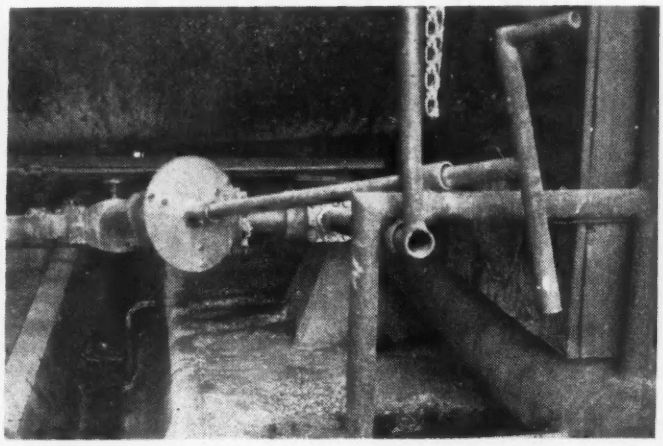
HOW TO—Extend Valve Stems for Safe Operation



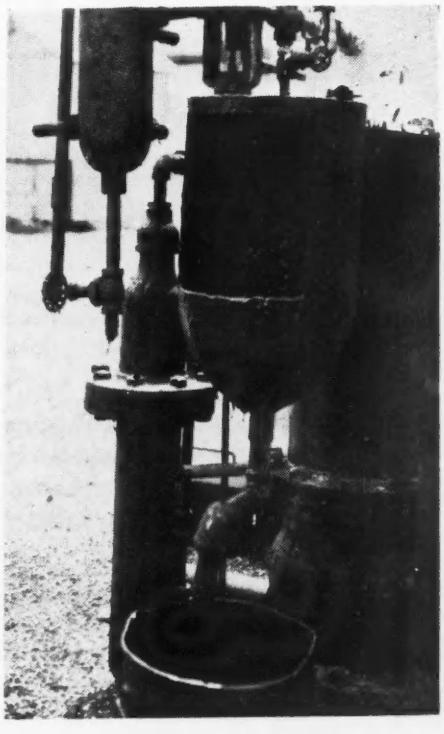
To provide added convenience and safety for the fireman when blowing down oil field type boilers used at a pipe line station, one company designed and constructed extension handles for the plug-type and angle valves. These valves control the discharge of sludge from the mud ring of the boiler to the burning pit.

The one-inch pipe extensions are supported by a right-angle bracket which is welded to an upright stack brace and to the boiler foundation. In order to maintain alignment, a bearing unit was made by welding a short section of 1¼-inch pipe to this supporting bracket, with the stem extension passing through the bearing. The plug valve stem extension is equipped with a single bar handle since it need only to be rotated through 90 degrees of arc. A crank with handle is welded to the end of the angle valve stem extension for making several rotations.

To prevent steam from blowing towards the fireman in case the valve stem packing in the angle valve should leak, a circular metal plate is bolted to the valve wheel to form a shield. Both valves are opened and closed from the runway between adjacent boilers so that the operator need not stoop or crawl under the barrel of the boiler during the periodic blow down.

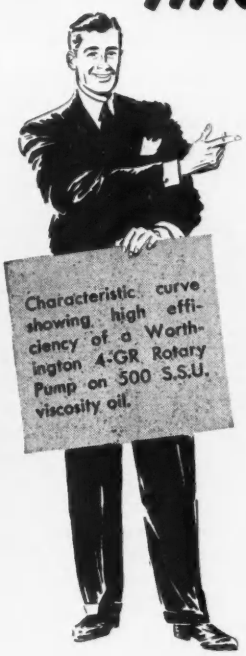
HOW TO—Install Sampler for Heavy Asphaltic Oil

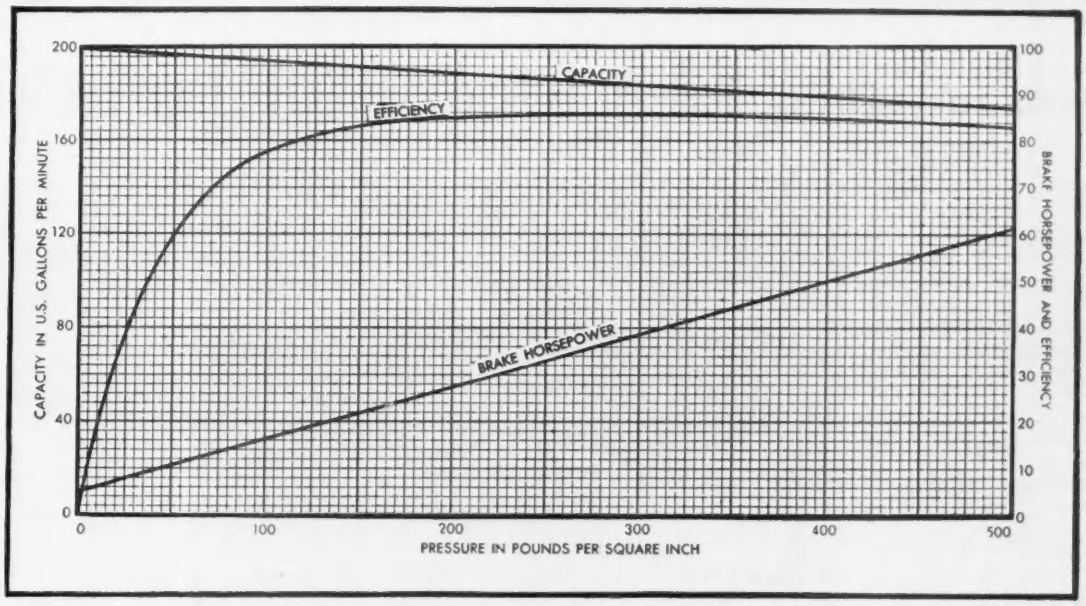
Previous to the installation of the sampler illustrated, a large company which daily dehydrates large quantities of heavy crude encountered unavoidable splashing of hot oil over the immediate surroundings. The sampler is made in the shape of a bull-plug, using a two-foot section of 12-inch pipe. The large end is closed with a flat head through which the sample line extends downward far enough that sample cans or bottles can be filled conveniently. The lower end is orange-peeled. A one-inch collar is added for nipples and fittings to drain excess oil into a pail beneath the sampler.



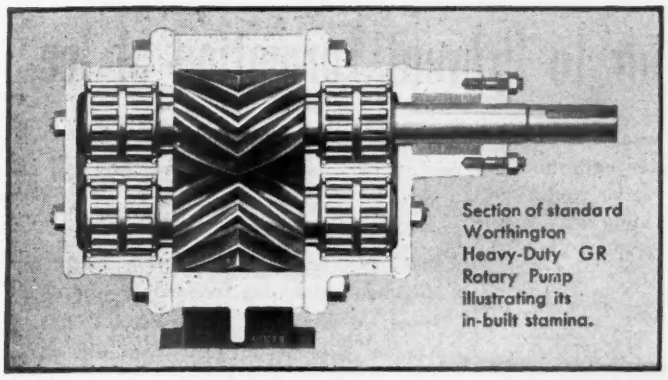
To provide access to the sampler, a section is removed from one side large enough that the treater can obtain a sample from the large line leading from a battery of dehydrators to the pipe line pumps. Oil that spills or overflows is caught by the sampler and directed into a five-gallon pail located directly beneath the device. In this manner, the excess oil can be disposed of safely and the dehydrators are kept neat and clean.

Imagine Performance Like This





IN A HEAVY-DUTY ROTARY PUMP



Section of standard Worthington Heavy-Duty GR Rotary Pump illustrating its in-built stamina.

WHERE SUCH EFFICIENT PERFORMANCE COMES FROM

- Accurate machining and close clearances provide high suction lift and keep losses in capacity low
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You, too, can insure top performance in handling gasoline, crude, bright stock, grease, asphalts, tars, etc., by specifying Worthington GR Rotary Pumps. Available with steam or water jackets and with inboard bearings and mechanical seals for overhung drives. Bulletins W-487-B10B and W-487-B11 give all the facts that prove *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Reciprocating Pump Division, Harrison, N. J.*

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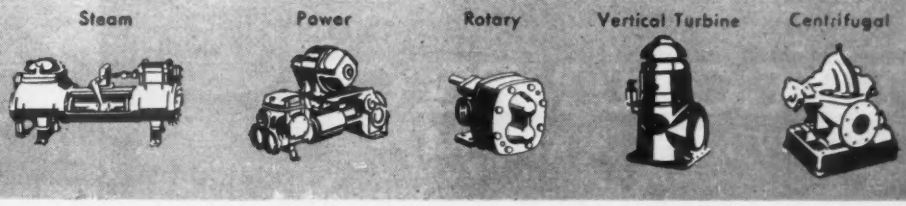
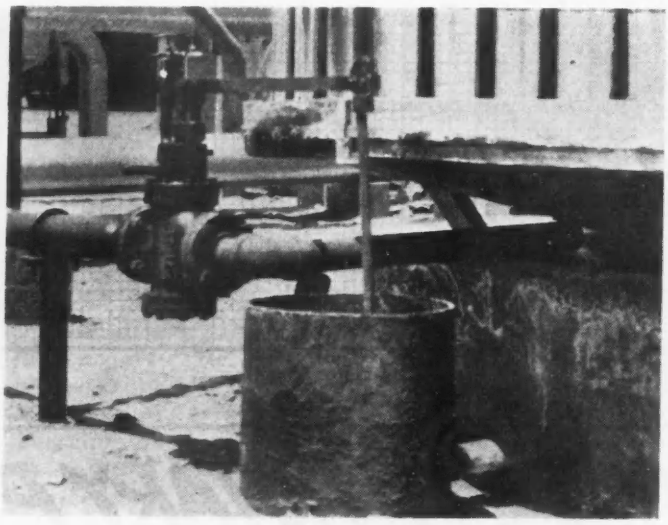


HOW TO—Control Makeup Compressor Interstage Cooling Water

Make-up of compressor interstage cooling water is accomplished by one pipe line company with a float control installed outside the water basin of the atmospheric cooling tower. This method is used for two purposes: the first is to place the float of the level controller at a point where maintenance is accomplished without difficulty, and the second is to prevent fouling of the ball float and maintaining a level of water in the basin within close limits.



A tank made from a piece of 20-inch pipe with a flat bottom is fitted with a two-inch pipe connector which extends through the concrete wall of the tower basin below the water level maintained in the basin. The small tank is located well outside the overhang of the cooling tower so that operators and maintenance men can service the unit without entering the tower. The level of water in the small tank represents the water level in the cooling tower basin and remains in a quiescent stage without turbulence so that the ball is not affected by eddy currents. The float ball does not ride the waves of the cooling tower water and it is anticipated that all joints and connections will have a much longer life because of steady operation.

HOW TO—Heat Condensate Valve Motor to Prevent Formation of Ice

In a compressor station which is operated at pressures approaching 500 pounds per square inch, quantities of condensate, both hydrocarbon and water vapor, are produced and must be handled with automatic flow control valves. Instruments and equipment operating in this type of service are prone to freeze due to hydrates and the drop in pressure across the valve wedge and seat or the balancing apparatus inside the body which acts directly upon the flow of liquids.

To prevent the formation of ice, one company has developed a particular style of heater which is both rugged and effective. The body is made of an appropriate size pipe nipple closed at the bottom with a flat welded head. To install the heater, slots are cut in opposite sides so that the body of the heater can be slipped entirely over the valve body and extend as far upwards as the yoke. A heavy sheet steel cover is made with a slot on one side from the outer edge to the center so it may be placed

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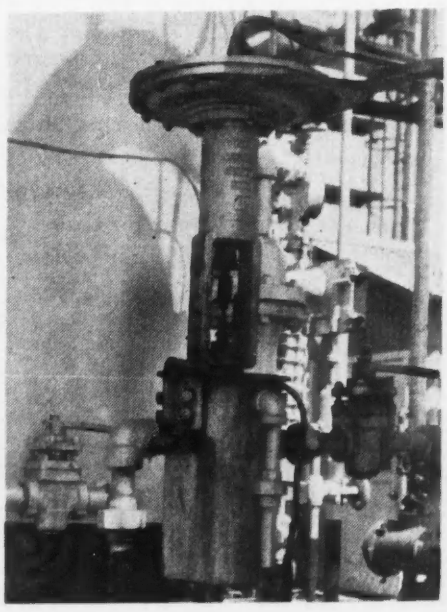

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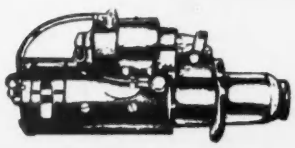

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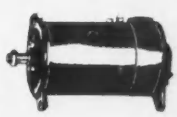

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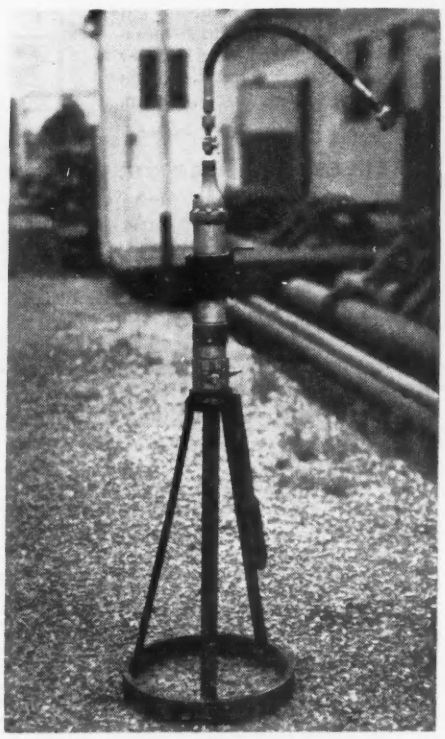
over the heater body in one piece by sliding across just under the valve yoke.

Holes are drilled and tapped for cap screws on both sides of the body for attaching brackets to both suspend the heater body and to close the slots. Copper tubing is wound around the body of the valve to conduct exhaust steam with the body of the heater acting as an insulating unit and a protector for the valve section of the controller.

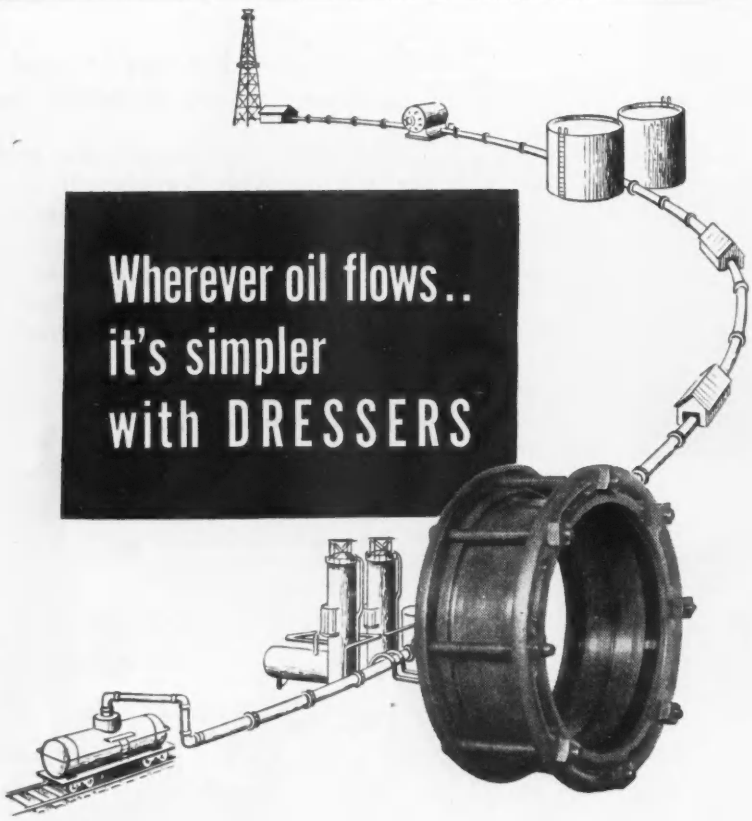
HOW TO—Construct Grease Gun Filling Stand

For pressure grease guns operating on air without hand controlled plungers, the job of filling the barrel was somewhat awkward when the oiler held the barrel in one hand and attempted to pack the lubricant down solidly for a full charge. During slack periods when the engines were running smoothly without attention being necessary, one of the operators assembled salvaged strap iron to make a holder for the grease gun barrel.

A large ring, approximately 12 inches in diameter was made for the base, to which three legs were welded with the apex attached to a ring just large enough for the head of the grease gun barrel to fit snugly in place. An extension of one of the legs extended to a point above the middle portion of the barrel where a circular gate with a hinge and lock pin was attached to hold the gun solidly while filling.



To fill, the gun is placed in the holder and locked in. Then the nozzle end is unscrewed, opening the gun barrel so the oiler can pack grease into it with the wood paddle kept closely at hand in a sheath attached to one of the legs. With this holder, the oiler is able to hold a can of grease in one hand while using the filling paddle with the other without wasting grease.



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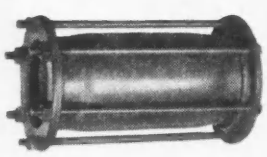

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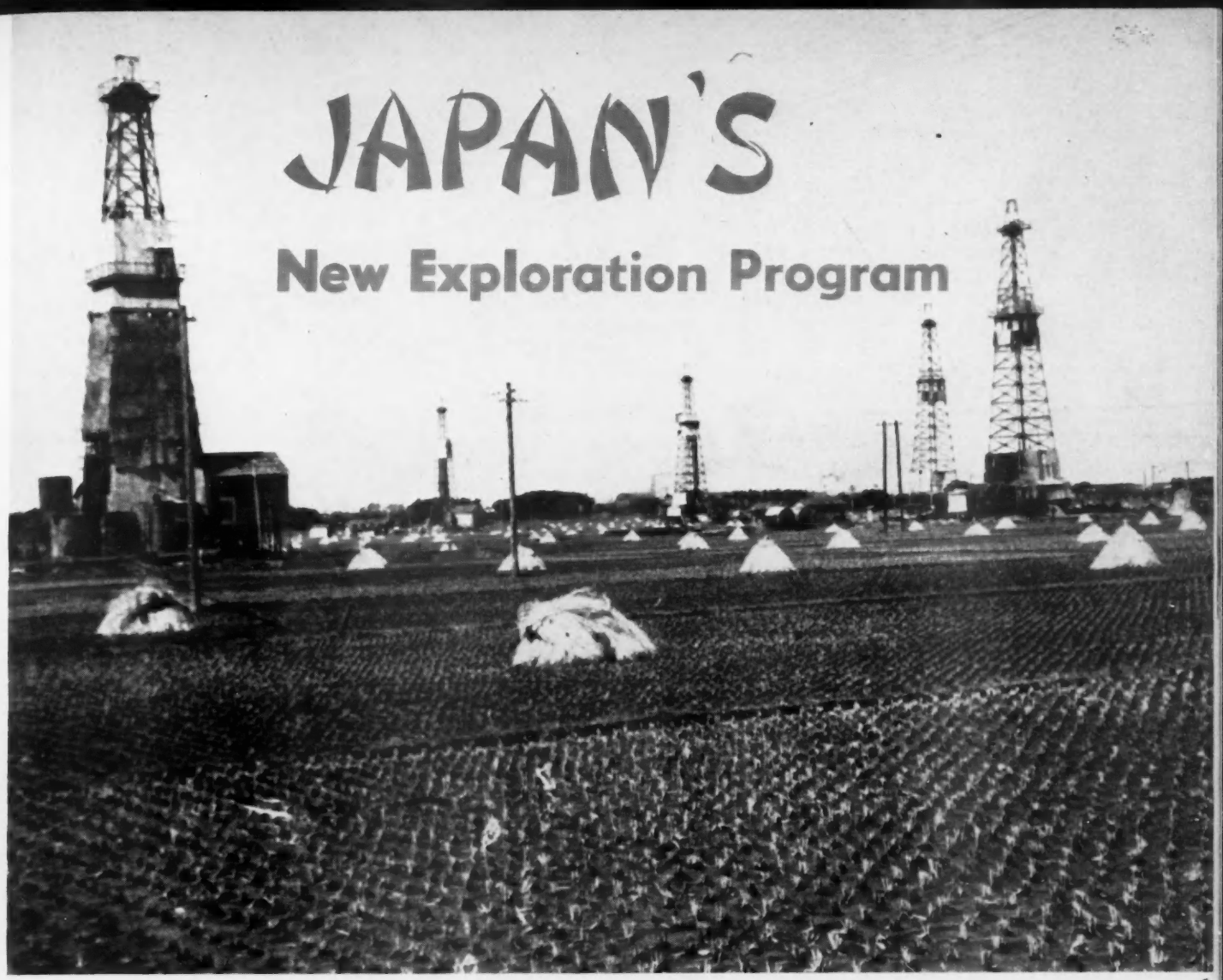
JAPAN'S New Exploration Program



Line of outposts testing zone extension on west flank in Koya area of Yabase field, Aketa prefecture.

TO REPLACE the hit-or-miss system of exploratory drilling in Japan, the Petroleum Exploration Advancement Committee was established early in 1947 to set up exploration projects, study survey results, select sites for drilling tests, etc. Results of the program for the first year indicate that new oil discoveries will be considerably increased because of this long-range planning. The program is described in the Weekly Summary No. 135 covering May 9-15, 1948, issued by the Natural Resources Section, General Headquarters Supreme Commander for the Allied Powers.

THE result of Japan's first year under the new coordinated petroleum exploration program hints at a considerably brightened future in development of indigenous oil resources. Under the direction of the committee set up in January, 1947, the industry was enabled for the first time in many years to find as much new oil as was produced during the past fiscal year. These new finds show possibilities of further discoveries in the present producing basins of the Japanese islands, and the surveys already made of other sedimentary basins have justified continuance of geological and geophysical investigation and probable drilling in regions which have thus far not been proved productive. Although the oil found has been in relatively small quantities, and in regions already proven, it is felt that it is the direct result of the new program.

Committee Formed

As a part of the overall effort to rehabilitate the entire economic system in Japan, the Petroleum Exploration Advancement Committee was established early in 1947 at the recommendation of the Natural Resources Section of General Headquarters, Supreme Commander for the Allied Powers. At the close of hostilities Japan was found to have drilled up most of its producing fields and the great majority of the fields had reached the depletion stage. Reserves of all of the 58 listed fields totaled only 14,137,623 barrels, according to best estimates made early in 1947. Even under rigid restrictions which have curtailed consumption to a minimum, the nation is able to produce no more than 21 percent of its needs.

The primary purpose of the committee was to promote discovery of new reserves by a comprehensive and coordinated search for petroleum by all known methods. The entire program is based on a broad study of the producing and potential producing regions of Japan with detailed regional study by geophysical and geological work, followed by drilling in favorable areas. The

committee is composed of representatives of producing companies, the Geological Society of Japan, the Mining Bureau of the Ministry of Commerce and Industry, and the geological and geophysical departments of academic institutions. It meets at least once a month to set up exploration projects, discuss the latest results of surveys, select locations for exploration drilling tests, and review applications for exploration drilling subsidies under the guidance of Natural Resources Section scientific consultants. The projects themselves are carried out by private oil companies under a government subsidy. Following the close of the war, and before the PEAC was set up, the exploratory drilling had been a hit-or-miss proposition, based on availability of drilling equipment and proximity of the equipment to locations easily accessible. The new cooperative program will put operations on a sounder basis with new tests drilled on the strength of geological evidence on a selective system.

The committee operates from the broadest possible viewpoint. Masses of information have been compiled, including geological maps of all the producing basins and some other sedimentary basins, all helping to base future exploratory planning on a more solid foundation. Regional subcommittees of PEAC, consisting mostly of the geological staffs of universities, made up geological maps on a scale of 1:50,000 which were used as the basis of final compilation by the Geological Survey of Japan on a scale of 1:200,000.

Value of Coordinated Effort

The combination of academic talent with the experience of commercial petroleum geologists and geophysicists has fully proved the value of coordinated effort under conditions such as exist in Japan. The committee's discovery of new reserves is an important contribution toward the economic rehabilitation of Japan. Before establishment of PEAC the staff of Imperial Oil Company, assisted by some parties from universities, carried on an exploration program confined to the producing basins. Reconnaissance field surveys in sedimentary basins outside the present producing areas were conducted during 1946 by a Natural Resources Section consultant and Japanese geologists. The results showed the need for a long-range program for further study of these potentially productive areas, while an immediate or short-range objective was a program to yield quick returns in the present producing basins in order to maintain the producing industry, which has been declining since 1938. The long-range objective is being worked concurrently with the more pressing immediate plans.

The success of the short-range policy is evidenced by the results of exploration drilling during the fiscal year 1947-1948 with Imperial Oil Company designated as the principal operator. During the period 62 wells had been scheduled, of which 40 wells were actually started, including some carried over from the previous year. Thirty-five of the wells were completed during the year, resulting in ten producers and 25 dry holes. New tests are scheduled as the program moves forward, and there are now 12 wells being drilled. All of these are in the exploratory classifications, including wildcats, new pool tests, and outposts. Although the entire program was not carried out completely because of financial difficulties, poor transportation facilities, and general economic conditions, the achievements thus far are considered creditable.

The exploration drilling program of the 1946 fiscal year which ran from April, 1946, to March 31, 1947, resulted in completion of one non-commercial producer for Imperial Oil Company and a few single outstep extension wells brought in by small independent companies. New reserves proved by drilling amounted to only 110,000 barrels. In the latter half of 1946 the Natural Resources Section recommended a considerable reduction in exploration drilling to avoid waste of critical drilling materials, as many of the locations were directed toward uneconomic objectives and few had a sound geological basis

TABLE 1

Successful Exploration Wells Completed by Imperial Oil Co., April 1947-March 1948

Well No. and Type	Drilling Period	Depth Drilled (Feet)	Formations Penetrated (Feet)	Type of Accumulation	Producing Zone	Initial Daily Production			Remarks
						Oil (Bbls.)	Gas (cft)	Water (Bbls.)	
AKITA DISTRICT									
Koya R-40 (Extension Well)	Jan. 25, 1947 Feb. 16, 1948	3171	246– 909 Sasaoka 909–1,443 Katsurane 1,443–1,476 Yabase tuff	Anticlinal	Zone VII at 3116 ft. in Onnagawa	27(F)	35,300	34	Proved deep production on west flank in Koya area of Yabase field; west flank formerly regarded as too steep. Further outposts now drilling.
Koya R-22 (Extension Well)	Aug. 10, 1947 Oct. 13, 1947	3168	1,476–2,788 Funakawa 2,788–3,171 Onnagawa	.....	Zone VII at 3116-3166 ft. in Onnagawa	75(F)	93,550	0.2	Locations based on subsurface studies.
Arava R-2 (Extension Well)	Mar. 25, 1947 May 29, 1947	3608	223– 689 Sasaoka 689–2,047 Katsurane 2,047–3,628 Funakawa	Anticlinal	Zone V at 2950-2263 ft. in Funakawa	13(P)	0	1	Small extension proved at South end of Yabase field. Location based on subsurface studies.
YAMAGATA									
Narahashi R-1 (New field wildcat)	May 19, 1947 June 17, 1947	1710	Shibikawa	Fault trap	10 ft. sand at 705 ft.	12(P)	0	10	Proved possibility of production in Narahashi ridge. Location based on geology and subsurface study.
Narahashi R-3 (New field discovery)	July 2, 1947 Aug. 28, 1947	737	Shibikawa	Fault trap	33 ft. of sands from 676–726 ft.	33(F)	0	4	Discovery well of Narahashi oil field. Location based on geology and subsurface study.
Narahashi R-4 (Extension Well)	Oct. 13, 1947 Feb., 1948	1155	Shibikawa	Fault trap	Sand at 740 ft.	..	Not determined		Completion awaiting pump installation. Location based on subsurface study.
Nishi-Ishinazaka R-6 (New field discovery)	Feb. 6, 1948 Mar. 16, 1948	837	Shibikawa	Fault trap	8 ft. sand at 829 ft.	13 (Bailing; later flow test gave 37 bbl. oil, no water)	0	41	Discovery well of Nishi-Ishinazaka field. Location selected after seismic survey and five structure borings.
NIIGATA DISTRICT									
Taya R-2 (New pool discovery)	May 20, 1946 June 7, 1947	4093	0–1,870 Nishiyama 1,870–3,280 Shiiya 3,280–4,093 Teradomari	Fault block accumulation	6 ft. sand at 3903 ft.	3(P)	10,250	19	Unimportant poorly productive pool in fault block on nose of Niitsu structure. Location based on subsurface study.
Betsuyama R-47 (Extension Well)	Feb. 13, 1947 Oct. 12, 1947	5576	0– 98 Nishikoshi; 98–1,279 Haizume 1,279–2,821 Nishiyama 2,821–5,576 Shiiya	Anticlinal	18 ft. sand at 4625 ft.	51(F)	83,200	18	Proved oil pool on steep flank below gas cap in Betsuyama block of Nishiyama field. Location based on subsurface study.
Betsuyama R-52 (Extension Well)	Sept. 14, 1947 Mar. 25, 1948	5287	About same as R-47	Anticlinal	Sand at 5110 ft.	23(F)	17,650	0.1	Proved extension of oil pool located by R-47. Location based on subsurface study

(F)—Flowing well. (P)—Pumping well.

Nishi-Ishinazaka R-6, discovery well of Nishi-Ishinazaka oil field, Yamagata prefecture. The derrick is boarded over to prevent oil spraying the rice paddies during bailing tests. The entire rig was hand carried across the muddy track in the right foreground to the location.

for selection, being largely a program designed to keep repatriated personnel in employment. A few of the locations already selected were approved and others selected to replace some of the rejected sites.

Of the 26 wells in this program which continued drilling in the next fiscal year, five were producers and two of these producers were replacements of the original program. Only three of the original 42 sites planned and completed for the 1946-47 schedule were producers, a discovery rate of only 7 percent. Five of the 25 wells which continued drilling in the 1947 fiscal year were completed as producers, a success rate of 20 per cent. Of the seven wells started and completed within the 1947 fiscal year, four were producers, a success rate of 57 percent, clearly demonstrating the success of the influence of PEAC.

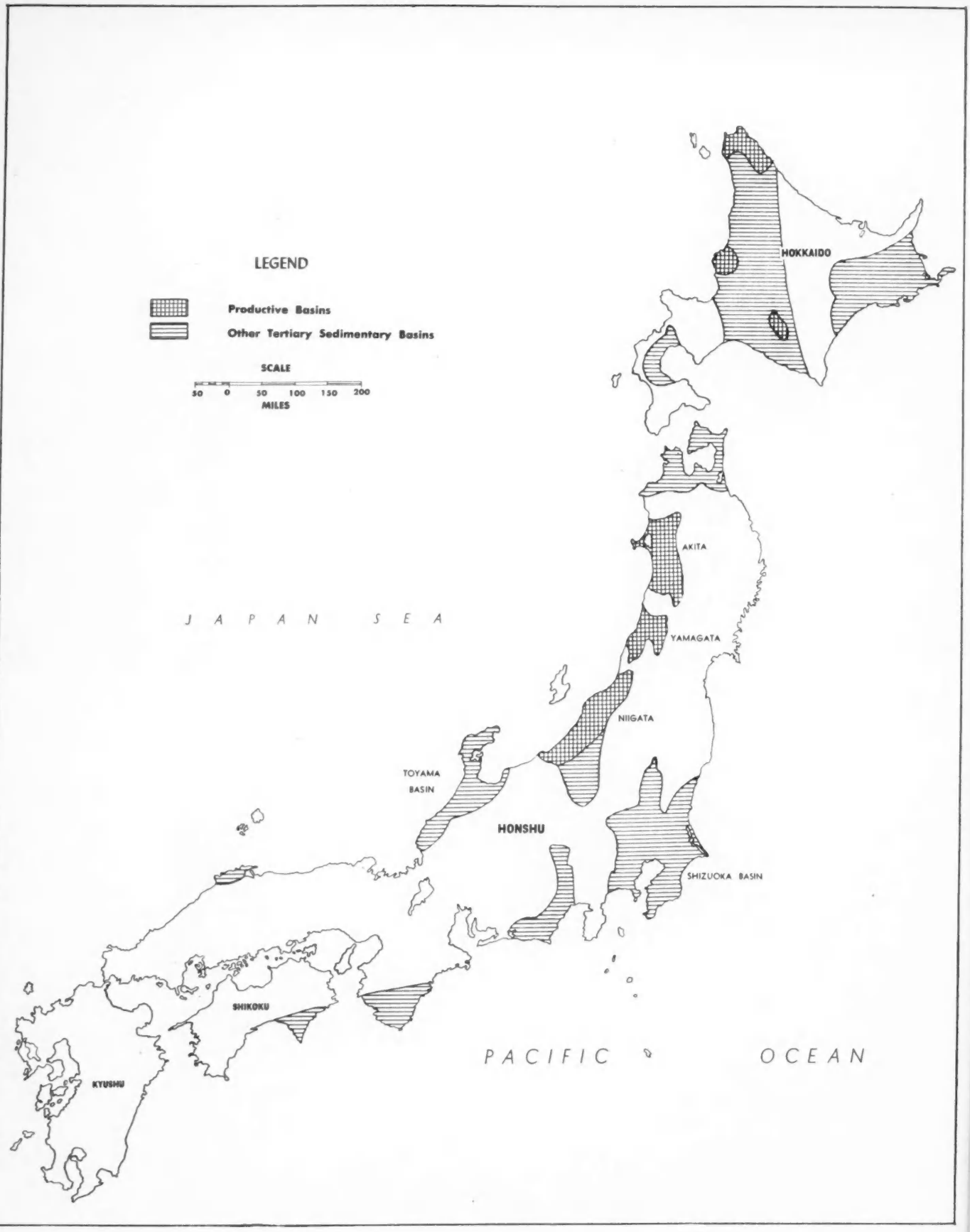
Although the results of the exploration drilling are insignificant in comparison with the scale of discoveries customary in the United States, they will play an important part in Japan's internal economy. Japan's present annual production of crude petroleum, standing at approximately 1,300,000 barrels, is about 10 percent of her present consumption level of petroleum products. Any increase in indigenous production means a saving of dollar credits on imported petroleum products presently supplied by the U. S.

1947 Completions

The total initial daily production for the ten producing exploration wells completed by Imperial Oil Company during the 1947 fiscal year is 250 barrels. The details of these wells are shown in Table 1. The Taya R-2 and Araya R-2 wells, both continued from the 1946 program, yielded no important results, and very little profitable area for exploitation can be expected. The two extension wells on the Betsuyama block of Nishiyama field, Niigata Prefecture, found the oil zone in the flanks of a steep, cross-faulted anticline which was formerly exploited for wet gas only. It is believed that five or more exploitation wells, each yielding about 30 barrels of oil daily, can be drilled on this narrow structure as a result of the test drilling.

The extensions so far proved in the Koya area on the west flank of Yabase anticline in Akita Prefecture by the first two of four planned outpost wells should yield at least six more exploitation locations, each averaging about 50 barrels daily. Results from the two additional outposts now indicate that the productive area will not be extended much farther down the western flank of the block, but additional development locations can be expected.

In Yamagata Prefecture two new small fields, Narahashi and Nishi-Ishinazaka, were discovered in the vicinity of Ishinazaka oil field. Narahashi field, to the north, is a new fault trap accumulation in a structure high against the northern extension of the main fault which bounds Ishinazaka field on the east. The proving of Narahashi indicates the possibility of further accumulations both to the north and south of Ishinazaka along the same structural trend. Nishi-Ishinazaka field is situated in rice paddies on the Shonai plain east of Ishinazaka field and was discovered by



Map of the principal Japanese Islands, showing area under observation under the accelerated program. It may be seen that the areas now productive cover only a relatively small part of the favorable sedimentary area of Japan. Currently 52 geological and 15 geophysical parties are working these areas, with particular attention to the non-productive regions.

seismic reflection surveys and structure drilling. It is a small fault trap accumulation against a fault parallel to that of the Ishinazaka-Narahashi trend. It is possible that other accumulations may be found along extensions of the faults.

When the assured exploitation locations resulting from all these discoveries are fully drilled up, it is estimated that about 700 barrels will be added to daily production. It is possible, however, that additional exploitation locations will be proved by further outposts in some of these newly discovered productive areas.

In addition to these tangible results of the exploration program, three structures were located by seismic survey in the producing basins, and several favorable prospects were revealed as a result of geological work. The most significant result from the long-range viewpoint is the location of more than 30 oil seepages and indications in an area of upper Cretaceous rocks in central Hokkaido, near large structures in which the oldest rocks exposed are not older than Paleogene. Several of these structures were surveyed geologically during the past year, and stratigraphic and facies studies were started. Results of the program in Hokkaido have raised hopes for the future, particularly in regard to the possibility of Cretaceous production, which never had been considered seriously in Japan. A well-coordinated series of geological surveys in the Toyama basin by several parties from Kyoto University revealed the existence of a greater thickness of possible source rock than was previously suspected, and two possible structures which are favorable for accumulation have been located.

The program has been executed solely by Japanese internal financing and equipment. The Japanese Government provided a subsidy of 43 million yen for oil exploration. Formerly, this total subsidy was applied to a 50 percent subsidy of approved exploration wells, except for a small sum to assist the oil mining project at Higashiyama. PEAC convinced the Government that 7 million yen of the amount should be applied to geological and geophysical projects. This enabled the survey program to include areas outside the present producing basins and financed the addition of many survey parties from academic institutions.

Most of the exploration was performed by Imperial Oil Company, in which the Government owns a half interest, and which still produces more than 90 percent of Japan's oil. It is the only existing organization large enough to finance and execute large-scale exploration. One of the most serious handicaps to progress of exploration has been the poor condition of the outmoded prewar geophysical apparatus available in Japan. The Government has tried to procure modern equipment but to date has been unsuccessful, as no yen-dollar rate of exchange is fixed and no dollar funds have been available for this purpose.

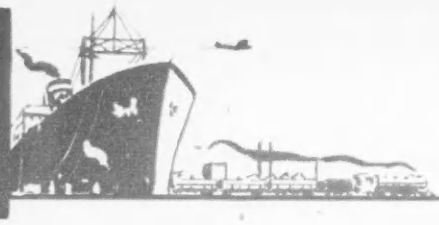
Because of the lag in adjustment of crude oil prices to rising costs of labor and materials, the industry has been struggling continually to maintain itself on a sound financial basis. The unsatisfactory financial status of the industry has resulted in labor troubles which have held back the planned programs. Considering all of these retarding factors it has been gratifying that such progress has been made. Although no accurate calculation of the reserves added by the year's discoveries is yet possible it is estimated that they are on the order of about 1,300,000 barrels, with a value of 700 million yen. Since it can be assumed that this was largely the result of the provision by the Government of a 43 million yen subsidy for exploration, making exploratory geological and geophysical work possible, the program is paying substantial dividends on the expenditure made by the Government.

TABLE 2
Status of Japan's Oil Reserves

DISTRICT AND FIELD	Estimated Proved Area (Acres)	API Gravity of Oil	Proved Reserves March, 1947 (Barrels)	Percent Depleted
HOKKAIDO				
Wakkanai	ND	ND	0	100
Koetoi	45	37	96,237	21
Masuporo	5	29	0	100
Menashi	10	33–40	0	100
Toyotomi	2	10–12	0	100
Yuchi	3	24	65,730	7
Ishikari	408	42	337,144	71
Atsuta	15	ND	Negligible	100
Kinausu	1	20	Negligible	ND
Fureoi	148	29	34,595	92
Karumai	129	29	Negligible	100
Total	766	.....	533,706	75
AKITA				
Higashi-Hachimori	42	16–19	1,805,589	16
Nishi-Hachimori	5	16–19	ND	ND
Iwako	11	21	0	100
Toyokawa	490	13	37,111	99
Urayama	187	13	ND	
Asanai	16	15	Negligible	100
Kurokawa	636	19	544,174	93
Michikawa	15	17	73,593	95
Asahikawa	67	21	135,235	
Niida	17	18–20	9,435	93
Yabase	508	21–24	5,573,569	62
Toyoiwa	3	25	Negligible	100
Katsurane	40	25–40	Negligible	100
Hanekawa	21	31	Negligible	100
Katte	62	33	67,932	90
Uchimichikawa	0	33	0	100
Matsugasaki	0	65	0	100
Hibiki	1	12	92,211	47
Kimigano	ND	ND	Negligible	100
Total	2,121	.....	8,339,659	77
YAMAGATA				
Innai	157	22–37	308,210	93
Kamioguni	83	ND	50,949	96
Katsurazaka	60	16–29	140,267	64
Kotaki	61	12–20	11,322	98
Kamihama	44	11–15	40,256	53
Chokaizan	66	9–10	49,691	87
Ishinazaka	28	17–19	559,810	28
Total	499	.....	1,160,505	84
NIIGATA				
Echigo-Kurokawa	111	19–24	99,413	62
Shibata	142	19–40	12,580	76
Kaji	7	ND	12,580	38
Tsukioka	2	ND	Negligible	100
Niitsu	357	17–18 30–35	1,492,617	92
Ohmo	127	19–31	27,676	98
Higashiyama	659	ND	1,871,715	78
Kengamine	3	46	Negligible	100
Torigoe	29	ND	Negligible	100
Izumozaki	1	.....	4,403	17
Ishiji	21	22–43	Negligible	100
Amaze	4	26–28	189	100
Miyagawa	39	25–51	22,015	99
Nishiyama	532	15–69	370,481	97
Betsuyama		ND	5,661	98
Takamachi	123	32–65	68,561	98
Kashiwazaki	16	38	126	97
Kuwazone	3	41	0	100
Maki	100	.....	115,736	88
Gohtsu	49	ND	0	100
Total	2,325	.....	4,103,753	91
SHIZUOKA				
Sagara	ND	40	Negligible	100
TOTAL—ALL FIELDS	10,590	.....	14,137,623	85

Note—ND no data

Rising Exports Cause Concern



By HENRY OZANNE
Staff Writer

RISING exports of pipe and other oil country goods from the U.S. are causing increasing concern among independent domestic producers and among certain members of Congress investigating the problem. The Wolverton Committee (House Interstate and Foreign Commerce Committee), which is engaged in the most all-inclusive inquiry into petroleum matters, has suggested that the present rate of exports of such materials may actually be in violation of the nation's policy of assuring that export rates will not adversely affect the country's internal economy.

The dilemma occurs because of the fact that the larger American firms operating abroad claim they are not receiving sufficient steel exports to expand their facilities at scheduled rates. This argument was most forcefully presented to the Wolverton Committee on June 30 by Howard Page, executive assistant to the president of Standard Oil Company (New Jersey). Page contended that the entire production programs of all companies operating in Venezuela were being threatened because the Office of International Trade was holding up steel export licenses. He said:

"Venezuelan producers have not been receiving scheduled deliveries of oil country tubular goods. They have not been receiving the required material for one reason only—inadequate export licenses. We formerly did not think it necessary to qualify our estimates that we could supply the oil from Venezuela if the producers had the steel, because they did have the steel, and it was inconceivable to us that operators in Venezuela, the major source of oil imports into this country, would be prevented by the U. S. government from receiving the tubular goods required and now available to them."

Page added that this situation was "the greatest obstacle today to increasing supply as rapidly as demand, and it is an arbitrary obstruction, not a physical roadblock, to adequate oil supplies."

Russell Brown, general counsel for the Independent Association of America, told the same committee that the blame should be placed instead on the fact that exports were already too heavy. He said:

"One of the factors in the present discouraging situation has been the rapid and steady increase in export shipments of materials for use in foreign areas. Exports of steel pipe used by the oil and gas industry are now running at the rate of approximately 460,000 tons per year in contrast to a prewar export rate of only 64,000 tons annually. This represents an increase of more than seven times over the prewar exports and 2½ times the 1946 rate of shipment.

"The export control law, which was designed to prevent injury to the domestic economy, has been operated to the benefit of activities in foreign areas at the expense of domestic operators in the United States."

Brown displayed a chart to show that during the years of wartime control the 26 large companies improved their position from 55.7 percent of the total production of crude petroleum in 1941 to 65 percent in 1945, the last year of Government controls. The remainder of the industry, according to his figures, "suffered a disproportionate drop in their share of the total output." He also presented a table showing that the percent of exports of oil country steel goods had increased from 4.1 percent of our production of such goods during the period 1935-39 to an expected 14 percent by the end of the current year.

Export Quota

A third quarter export quota has been set by the Department of Commerce totaling 136,000 tons of steel for casing and pipe, compared with the second quarter quota of 115,500 tons and a 1947 quarterly average of 99,755 tons. The 136,000 ton third quarter figure includes 60,000 tons of seamless casing and oil line pipe and 45,000 tons of welded casing and welded oil line pipe, as well as 10,000 tons of seamless black pipe and 21,000 tons of welded black pipe.

Of the third quarter export steel quotas set by the Department of Commerce, 110,000 tons is for oil projects. This includes 70,000 tons for Latin America, 35,000 tons for the Middle East, and 5000 tons for the Far East.

Taking note of the protests against exports, Acting Secretary of the Commerce Department T. C. Blaisdell commented: "We are aware of the serious shortage of oil line pipe, casing and tubing in our domestic oil industry. It is understandable if some domestic producers are not easily reconciled to the necessity of exporting even minimum qualities of steel for oil production in Latin America and the Middle East." The Department reported that applications for third quarter export licenses totaled 567,829 tons, representing casing and oil line pipe alone.

Testifying before the Wolverton Committee, John C. Virden, director of the Office of Industry Cooperation in the Department of Interior, said that "from the start the most critical situation of all was in iron and steel." He added: "The stated requirements for the oil and gas industry are startling in their magnitude. Although no voluntary agreements have as yet been effected, some are in process which should assure a more balanced situation."

Virden said an effort was under way to improve the steel shortage situation through scrap imports from Germany. To date, 600,000 tons of scrap have been received from Germany and 240,000 tons more are due this year. Other Commerce Department officials estimate that 3 million tons of finished steel were lost to the U. S. last year because of the lack of scrap.

Anxiety over the whole export problem is heightened by new analyses being made of the cost of the European Recovery program. More than 20 percent of the total dollar volume of aid projected under the Marshall Plan represents petroleum and its derivatives. The domestic independent oil producers have been in agreement with the major companies that the Economic Cooperation Administration should purchase all possible ERP oil outside the United States with the exception of lubes and greases.

Wild Well Proves High Potential of Leduc Field

The lake of oil for many acres around the well has taxed the capacity of pickup and transportation facilities.

By C. O. NICKLE, Staff Correspondent

BY THE end of July, Alberta's government and oilmen hoped, the wildest well in the history of the province's oil industry would be brought under control. By that time, two relief holes alongside the wild Atlantic-Leduc 3 well were expected to complete drilling and permit closerange water flooding of the mile-deep wild producer. Once the well has been killed, oilmen will start figuring the cost and the effect of the blowout on the 200 million barrel Leduc oilfield.

The Atlantic well blew wild on March 8 when, in space of less than a minute, drilling mud disappeared into apparently cavernous porosity in the D3 zone. The well would have halted drilling and run casing within a few hours had the blowout not occurred. After 38½ hours, the crew managed to cap the well. Then oil and gas burst out around the 300 feet of surface casing. Within a few days oil and gas were pouring out through shot-holes a quarter of a mile away and then burst out and formed craters through the grain field surrounding the well. As weeks passed the grain field was turned into a violently erupting emulsion of mud, oil, and gas, with core of that particular cratering centered about 100 feet north of the derrick.

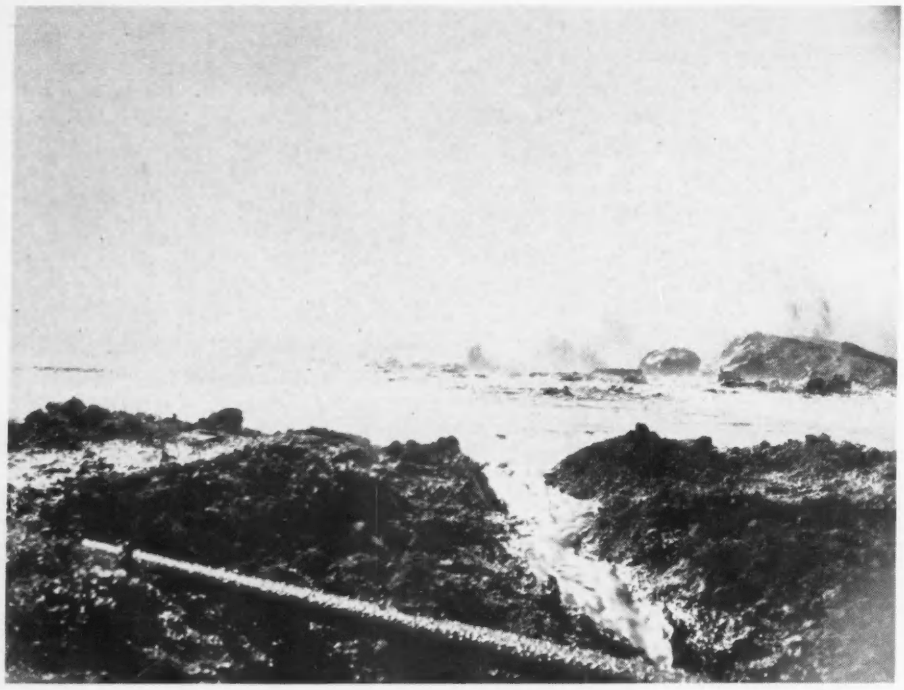
ACCOMPANIED by an Alberta government photographer and Conservation Board engineers, the writer visited the wild well at Leduc late in June. Pictures accompanying this report show the violently erupting 'crated area' adjacent to the well, through which is being produced from 10,000 to 14,000 barrels daily of high gravity oil, plus between 30 and 50 million cubic feet daily of natural gas. The crater area is around 100 feet square. Oil from it flows into hastily banked sumps and pits spread over several acres of what once was prime wheat land.

In an effort to plug the well, many thousands of barrels of cement, mud, and a wide range of filler materials were pumped in through the gun-perforated drill pipe. All efforts were of no avail.

Conservation Board Control

On May 14 the Conservation Board took over the wild well and temporarily suspended normal producing operations in the field so that entire pipe line capacity could be used to pump oil from the rapidly spreading lake around Atlantic 3. Under its direction 691,000 barrels of water were pumped into the Imperial 48 well (one-fourth mile west of the wild producer) in an effort to flood the formation. This operation was suspended when it became apparent that the only noticeable effect was a boost in the wild well's oil yield from around 8000 to more than 14,000 barrels daily. (Up to July 10, no water has shown in Atlantic's flow.)

Meanwhile, drilling was started on two relief holes, one 700 feet west and the other 700 feet south of the wild producer. Directionally drilling to tap



After nearly five months of uninterrupted flow, a huge volume of oil has soaked into the ground or been lost in shallow sands.

the oil zone at base of the Atlantic well, the relief holes were around 4600 feet on July 10. Close range water flooding is expected to kill the well.

During the first part of July, Atlantic 3 was averaging about 12,000 barrels per day of oil plus an estimated 30 to 50 million cubic feet of gas. About 1000 barrels daily was coming through the wellhead and the balance through the crater area.

By the end of June, the well had staged a $2 million plus blowout and was still flowing oil worth more than $40,000 daily. Naturally, no one is happy about it. No one knows whether the wild well will pay off the high costs of killing it and settling for damages done by it, let alone provide a profit to the company that drilled it.

During June 331,087 barrels of oil (11,039 barrels daily) were accounted for. Of this total 207,225 barrels were delivered to market through the Imperial pipe line system. Another 123,862 barrels were returned to the mile deep reservoir through the nearby Atlantic 1 and 2 wells, which the Board put into service as input wells early in June. First deliveries were made in May, when Atlantic Oil Company put 39,231 barrels into the pipe line and the Board (which took over May 14) delivered 177,744 barrels. By end of June a total of 548,062 barrels were accounted for. An unknown volume of oil produced by the well was still in the oil-soaked ground around the well site at the end of June.

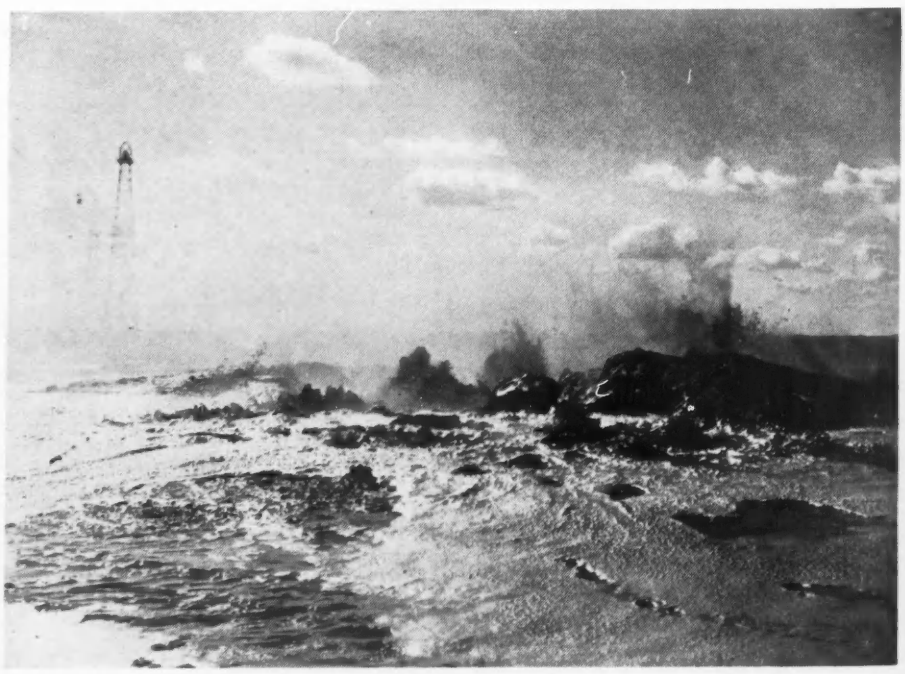
In terms of dollars the oil accounted for has a gross value (at $3.45 per barrel) of about $1,891,000. Oil still on the ground at end of June would certainly boost actual value of the wild well's total output over the $2 million mark.

The amount grossed by the Conservation Board from sales to end of June would be about $1,328,000, made up of $715,000 value of June deliveries and $613,000 in May. The Board is paying costs of control efforts from these funds and still has to decide on distribution of any proceeds which might remain after the well is killed. Gross value of oil delivered by Atlantic Oils in May was over $135,000. Value of oil returned to the formation (for recovery in the future) would be over $427,000.

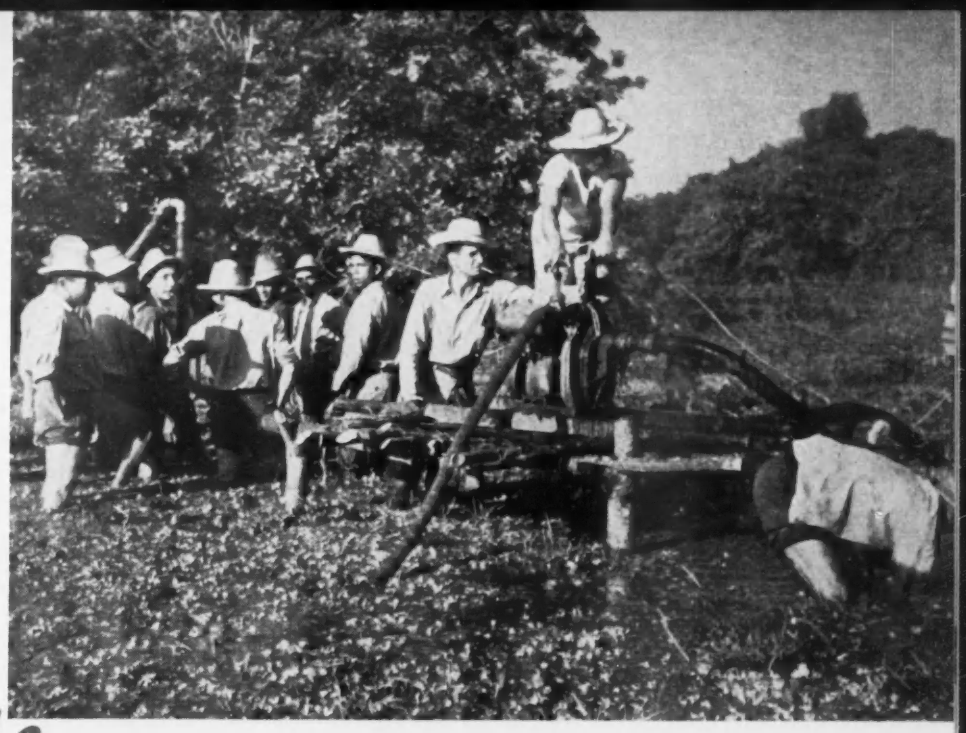
By June 4 the lake of oil around Atlantic 3 had been pretty well cleared up by deliveries to the pipe line and the Board decided to allow partial resumption of normal operations in the field. During the balance of June and to date of writing in July, all wells were allowed to produce 80 percent of normal allowables. D3 zone wells have been producing 120 barrels daily, compared with normal allotment of 150 barrels. D2 zone wells have been operating at 80 barrels, compared with normal allotment of 100 barrels.

During the first week of July, daily average throughput of the Leduc pipe line was 15,784 barrels. Of this, Atlantic 3 provided 7834 barrels. Eighty-three other wells, operating at reduced quotas, provided the balance. (In addition, about 4000 barrels daily from the wild well were returned to the formation.)

To many a Leduc oil producer, the performance of the wild well has indicated that the Board allowables are somewhat less than maximum efficient flow rates. When Atlantic 3 has been killed and the field returns fully to normal, there will undoubtedly be agitation for a conservation system based on capabilities of individual wells to replace the present blanket system of maximum quotas for any and all wells. (The Board originally set its 100 barrel D2 and 150 barrel D3 quotas as a temporary measure, pending securing of additional data on the field to permit creation of a conservation system.)



Oil gushing out of fissures more than 100 feet from the well-head. Such eruptions occur over an area of 40 acres around the location.



Shothole drilling in Northern Colombia geophysical exploration. Operation of one instrument requires total labor force of 125 men.

By GEORGE O. IVES
International Editor

Colombia's Labor and Legal Problems

JULY found Colombia faced with the solution of two problems, either of which is capable of having a profound effect on the future of its oil industry. First in importance is the grave matter of relations between management and labor. Of hardly lesser importance is the consideration of new oil legislation. While the correct handling of either of these matters is of particular importance to any oil producing nation, it is doubly important to a nation whose petroleum future depends to such an extent on reserves yet to be discovered. If Colombia is to continue to attract operators willing to spend substantial sums in the search for and development of petroleum resources, it will hardly do so by materially increasing the costs of exploration and development.

The labor agreement under which companies have been operating expired on July 1 and negotiations for a new pact were approached with a great deal of concern. Labor costs have risen sharply during the past two or three years, both direct cost in the form of wages and indirect costs in the form of social and economic benefits. In the past it has been possible for a certain amount of bargaining to take place between management and labor on various issues, but the outcome of the 50-day strike which took place on the De Mares Concession early this year, presents none too bright an outlook for negotiations on the new contract.

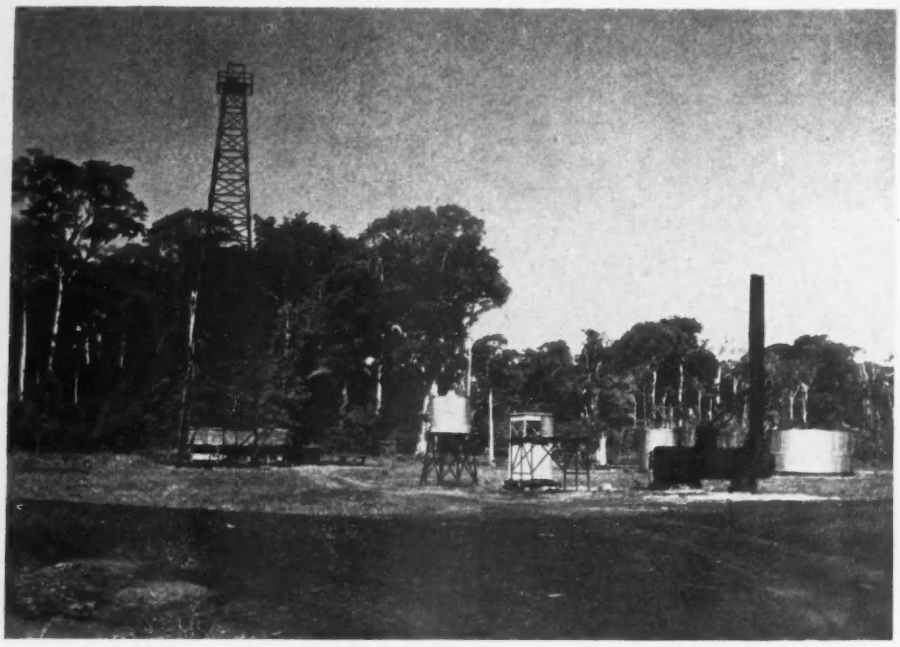
The strike against Tropical was settled by forced arbitration, which had the effect of affirming all of the labor syndicates' claims. Tropical Oil Company had discharged 107 employes from a staff of more than 3800 simply because there was no longer anything for them to do. Production from the fields on this concession has declined to slightly more than 13 million barrels annually, compared with a 1938 output of more than 21½ million barrels. The La Cira and Infantas fields are completely drilled up and production declines are being kept at a practical minimum by secondary recovery methods. Normally such a property would now be operating with a minimum of personnel, only a fraction of the force required during the active development phases. Settlement of the strike was forced by the government and resulted in reinstatement of the discharged workers. This means that Tropical must continue to provide housing, medical, educational, social, and recreational facilities for all workers and their families. The union leaders are insisting that the current labor contract be retained in force until such time as a new one is signed.

Now labor wants to include in its new contract assurance that none of the personnel will be discharged before the concession reverts to the government on August 25, 1951. It wants, among other things, a 50 percent wage increase, new medical and housing services, a double Christmas bonus, and a new bonus for Easter. In connection with the negotiations for a new contract, the Ministry of Petroleum has expressed itself as favoring the present status, with no reduction in personnel.

Management-labor relations is clearly one of the dominant issues in the industry in Colombia. Apparently management will not have the right to adjust its personnel requirements to meet the needs dictated by the technical and economic situation. Declining production, approaching the stripper stage, may have to support the same personnel required by peak development activity. At the time of latest reports from Colombia no progress was being made in attempts to reach an agreement. Meanwhile, the Council of State is studying the validity of the reinstatement decree.

Late in June a decree was issued by the government providing a new legal procedure for settlement of strikes and also providing that a strike may be declared illegal unless a majority of the workers vote for it in secret balloting. Very few details are now available as to the methods of arbitration under this plan but it seems due for a test before very long, since reports have been received that movement of river boats on the Magdalena may be halted because the owners of the river fleets say they can no longer operate under the continued demands of labor. These boats carry freight and mail for most of the interior of Colombia.

Of special importance to oil operators is the 150-day session of the Legislature which convened on July 20. The new oil law, which was passed by the House in 1947, is scheduled for consideration in the Senate during the course of the session. Late in 1947 it had been thought a foregone conclusion that the bill would also pass the Senate without a great deal of opposition. With changing conditions during the first part of this year, it is apparent that with added study by solons and by Colombian economists, there is a growing feeling that it should not be passed in its present form. There is be-



One of two producing wells with which Cantagallo field goes into exploitation.

ginning to be an understanding that if operators are to be encouraged to explore and develop oil reserves in Colombia, the law under which they must act should be revised.

As it now stands, the law places an economic burden on exploratory operations as well as on actual development and production. This added burden could be better borne in established producing nations such as Venezuela than in Colombia where productive capacity is still concentrated in a few fields with relatively restricted potentialities. Of four concessions now producing commercially, only one can be considered as having actually returned the entire capital investment, while the others are still operating at a loss. There is also a growing feeling among students of the industry that the new petroleum law should contain some type of guarantee to company management in regard to labor, strikes, and social problems. In the opinion of some representatives of oil firms, Colombia would do well to retain the present oil law with addition of certain clarifications and provisons.

Provisions of New Bill

The new bill, prepared by the National Petroleum Council, is an entirely new oil code, designed to supplant rather than supplement the present petroleum law. It has some desirable provisions, but in the main tends to levy increased costs upon exploration and exploitation. In the case of established production, the increase in royalties and the higher tax on oil from private property would not be particularly onerous although it does seem a bit high in view of the inadequate depletion allowance in the income tax law, which is given as "up to 5 percent of the net income." An additional expense of operating producing properties is imposed by requiring payment of surface rental throughout the commercial life of the concession, and the reversion to government ownership of immovable installations upon surrender of the property.

Experienced observers feel there are both good and bad features in the proposed statute in regard to petroleum grants, which would be divided into various classifications such as exploration permits, wildcat concessions, and exploitation grants. Having three separate types of grants would make possible more flexibility than is provided in the present all-inclusive contracts, but in the original draft there is no provision for priority of bidding. There is also no provision for surrender of the exploitation grants although both exploratory types could be surrendered without penalty. In the case of exploitation permits, the bill states that they could be surrendered if the operator has complied with all of the obligations. One obligation is a complete boundary survey which might take as much as three years, and no provision was made to waive this obligation.

In contrast to the present law, the new bill does not call for obligation to drill a wildcat on concessions taken, since it imposes high surface rentals and taxes during the initial period. In a way this provision might promote early drilling since the rentals scale upward through the latter periods of the concession, but it is feared that the high rentals constitute an added burden to the already high costs of operations. Another change in the new law as compared to the present set-up is the elimination of the rule stating in effect that no operator may hold more than two concessions. This was originally intended to keep operators from blocking up huge amounts of property under concession, but actually it merely led to the formation of separate affiliated companies whenever an operator applied for new concessions. There are now more than 160 companies operating in Colombia, most of which are owned by the seven or eight major operators.

Cost of Wildcatting

An idea of the cost of wildcatting in Colombia, where each operation presents a major problem of transportation and supply, is given by a recent stockholders report by Petróleos Ariguaní S.A. This company, jointly owned by Tropical Oil Company and a group of Colombian nationals, was formed for the purpose of carrying on wildcat operations in the

Typical Magdalena Valley jungle encountered in the greater part of Colombia oil operations.

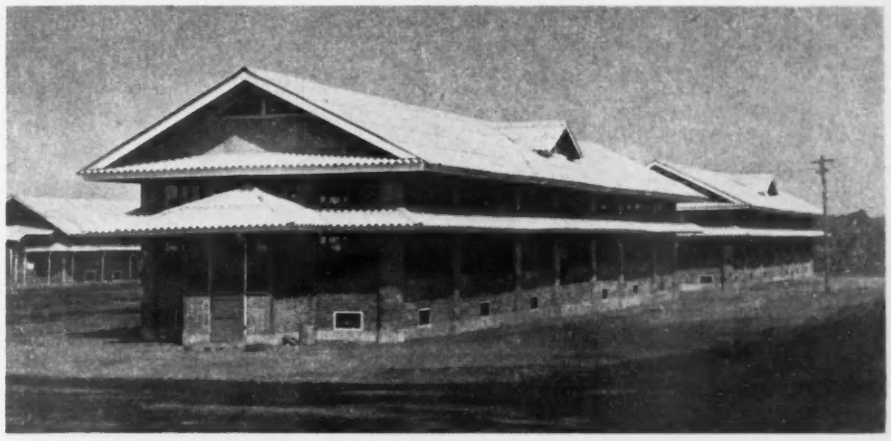
Lower Magdalena Valley. The report, made public in the latter part of May, itemized the expense incurred in drilling two wildcat dry holes on nearby concessions which have now been surrendered.

Ariguaní was formed with a paid-in capital of $4,275,000, contributed by some 2241 shareholders. It obtained concessions from the government on two tracts, the Costarica and Granada blocks, each containing just under 125,000 acres. Tropical Oil Company carried out extensive geological and geophysical work on the tracts starting in 1938 and extending through 1946. The grants were actually contracted on May 17, 1945, and November 24, 1944, and the Costarica well was started in September, 1945. This well went to a total depth of 10,609 feet and the attendant work cost $1,484,917. The rig was then moved to the Granada block nearby where two relatively shallow holes were drilled to 3860 feet and 4504 feet, respectively. These two cost a total of $1,650,083, the cost being increased by a blowout and fire which occurred on Granada 1 and destroyed a drilling rig valued at $350,000. The total cost of prospecting the two blocks amounted to $3,135,000.

In the report Ariguaní called attention to the taxes and surface fees borne by wildcatting. In their case the capital assets tax, surtax and surface fees for both blocks totaled $148,117.

Following its experience in wildcatting, it has been reported from Colombia that the company is contemplating making a bid to the government for the De Mares concession in 1951. The firm of DeGolyer and MacNaughton has been retained to make a technical study of the fields of the concession and appraise its worth. Although it is still some three years before the concession expires, it was thought that an early bid might have the effect of sounding out the government policy in regard to the disposition of the property, and if it were favorable, more time would be available for preparation.

A number of possibilities have been mentioned from time to time as to the final decision on what is to be done with De Mares, ranging from an extension of Tropical's concession, through mixed private and government operation, to full operation by the authorities. There was much discussion over formation of a government company for the purpose, but recently that possibility seems more remote. In any event there is quite likely to be some difficulty with labor at the time when a decision must be reached, as it is reported by observers that labor on the concession has the impression that the property was to be turned over to them. Despite the decline in production Des Mares would be a valuable property to anyone not required to make the full capital outlay for development and transportation facilities, since it is still producing in the neighborhood of a million barrels of oil a month.



Housing supplied for bachelor workmen in Shell's Casabe field, Middle Magdalena Valley.

Meanwhile Tropical Oil Company has indicated in a letter just made public that it is ready to discuss the future of the concession with the government and is ready to cooperate in any way that may benefit Colombia. It stated further that the company is ready, if the government desires, to try to work out a satisfactory formula whereby the property could revert to the government before 1951. Tropical recounted its activities on the concession, pointing to the 49 wildcats drilled outside the La Cira and Infantas fields and discovery of eight anticlines as evidence of its diligent exploration of the tract. At La Cira and Infantas 1313 wells have been drilled, including 11 deep wells to the Cretaceous, and a productive area of 16,500 acres has been proved. With the single exception of Colorado field, none of the other structures have been found to be commercially productive.

The Shell Group has materially improved its productive position in Colombia in recent months, both through increases in the output from the Casabe field and in the outlook for El Difícil field which is scheduled to go on production with completion of a new pipe line in August. The Casabe field, on Yondo concession, has passed 15,000 barrels daily now, having maintained an average of 15,400 barrels during May, and now has more than 80 productive wells completed through continued operation of three rigs. Particularly heartening for Shell was its latest completion at Difícil, the No. 22, which flowed on recent tests at the rate of 1200 barrels daily through a 20/64-inch choke and 1875 barrels daily through a 28/64-inch choke. Difícil 21 was also a good producer, and it appears that with present trends the capacity of the new line may have to be increased before very long. However, Shell's huge investment in Colombia is such that it will not be returned for many years.

The Socony-Vacuum group's extensive outlay for a disappointing exploratory program has caused the company to sharply curtail its activities, and at the present time the company has no wildcats drilling other than those in whch they hold a part interest and which are being operated by the other partners. The only commercially producing area resulting from the program has been Cantagallo field, where a series of 13 wells resulted in completion of two producers with a combined daily output of approximately 1000 barrels. Small, non-commercial production has been found at Las Monas and at Sinú.

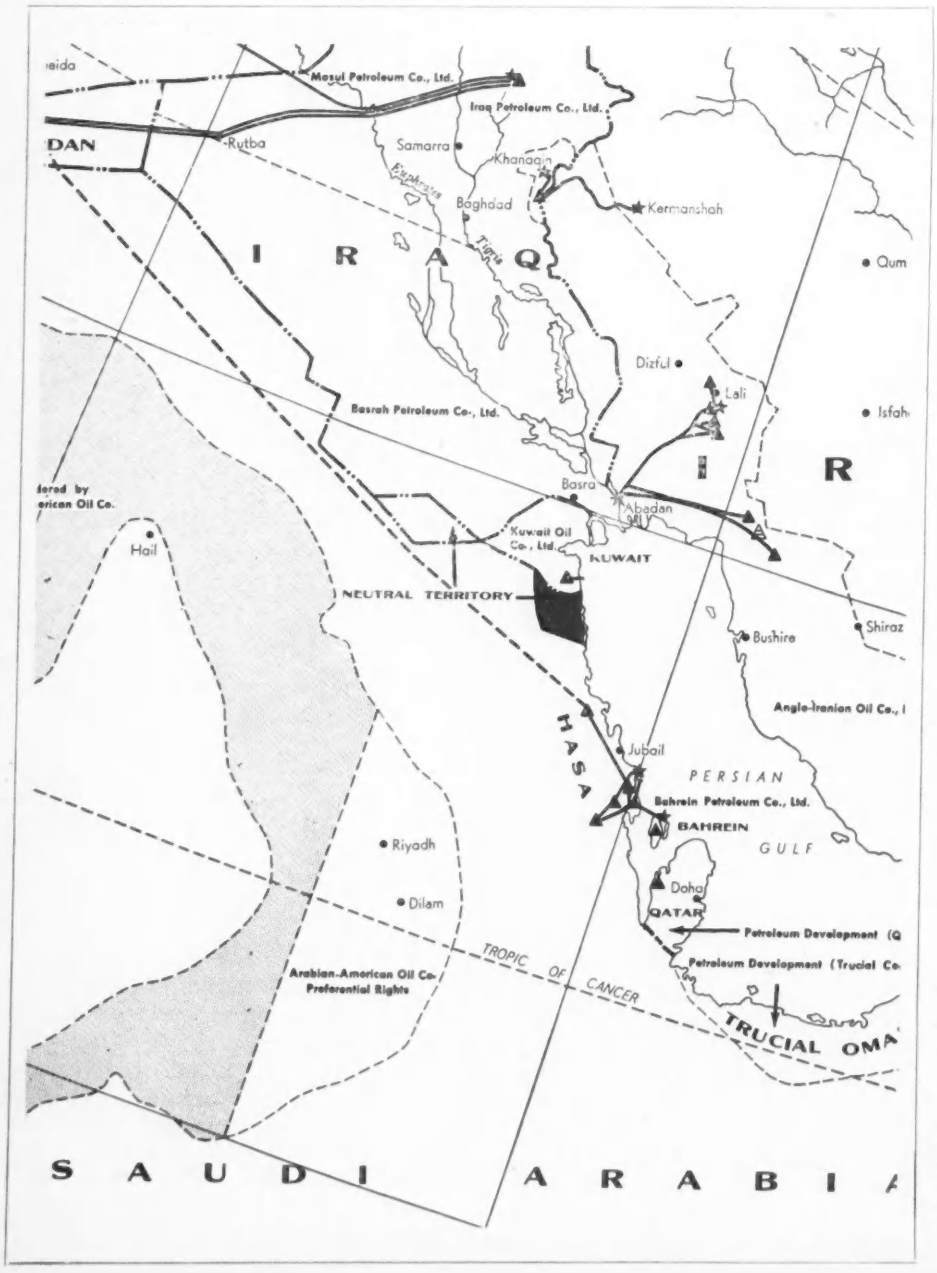
The Texas Petroleum Company has spent many millions of dollars in Colombia with the Velasquez field as the only encouraging result. This new field now has two producing wells out of four drilled and is still faced with the necessity of building up sufficient potential to warrant the tremendous investment necessary to build a pipe line outlet. The company is now starting two wildcats in the extreme southern part of Colombia in the upper Amazon area, one of the most remote regions in the country, where operations are perhaps more costly than in the better-known Llanos region. In addition, it is still wildcatting in the Lower Magdalena Valley, where gas showings testing 15 million cubic feet daily have been found on its Tablon block.

Meanwhile, Tropical Oil Company is carrying on an active wildcatting campaign in an effort to establish production against the time the De Mares concession must be released, but it has been unsuccessful thus far. The company has been spending some $15 million yearly in Colombia but has slashed its budget to less than half that as a direct result of labor and political difficulties.

Colombian Petroleum Company is doing no wildcatting outside the confines of the Barco concession, where it has increased its output to 22,500 barrels daily. It keeps six rigs running at Tibu field, most of which are drilling for Tertiary production which makes up the bulk of the output, while two rigs are normally kept busy on the deep and expensive Cretaceous wells.

American Independent Oil Company Enters Middle East

NEGOTIATIONS have been concluded between American Independent Oil Company and Sheik Ahmed al-Jabir as Subah, ruler of the Arab state of Kuwait, granting the American company a concession in the Kuwait Saudi Arabia Neutral Zone. Terms of the concession, its extent, significance, and possible effect, are discussed in this article.



Map of principal Middle East producing centers. Colored area indicates Neutral Zone in which American Independent Oil Company has concession from Sheik of Kuwait. Arabian-American Oil Company holds preferential rights on Saudi Arabia's half-interest in same zone.

AMERICAN Independent Oil Company plans to begin petroleum exploration and development activities on its newly acquired concession in the Kuwait-Saudi Arabia Neutral Zone, in the heart of the major oil region of the Middle East in the near future.

American Independent was formed in August, 1947, by ten substantial independents who pooled resources and experiences to engage in foreign operations. The company, with an authorized capitalization of $100 million, includes J. S. Abercrombie, Houston; Allied Oil Company, Cleveland; Ashland Oil & Refining Company, Ashland, Ky.; Ralph K. Davies, San Francisco; Deep Rock Oil Corporation, Chicago; Globe Oil & Refining Company, Wichita, Kansas; Hancock Oil Company, Long Beach, Calif.; Phillips Petroleum Company, Bartlesville, Okla.; Signal Oil & Gas Company, Los Angeles; and Sunray Oil Company, Tulsa.

Terms of Concession

It is understood that terms of the concession just negotiated by American Independent and Sheikh Ahmed al-Jabir as Subah, ruler of the Arab state of Kuwait, include:

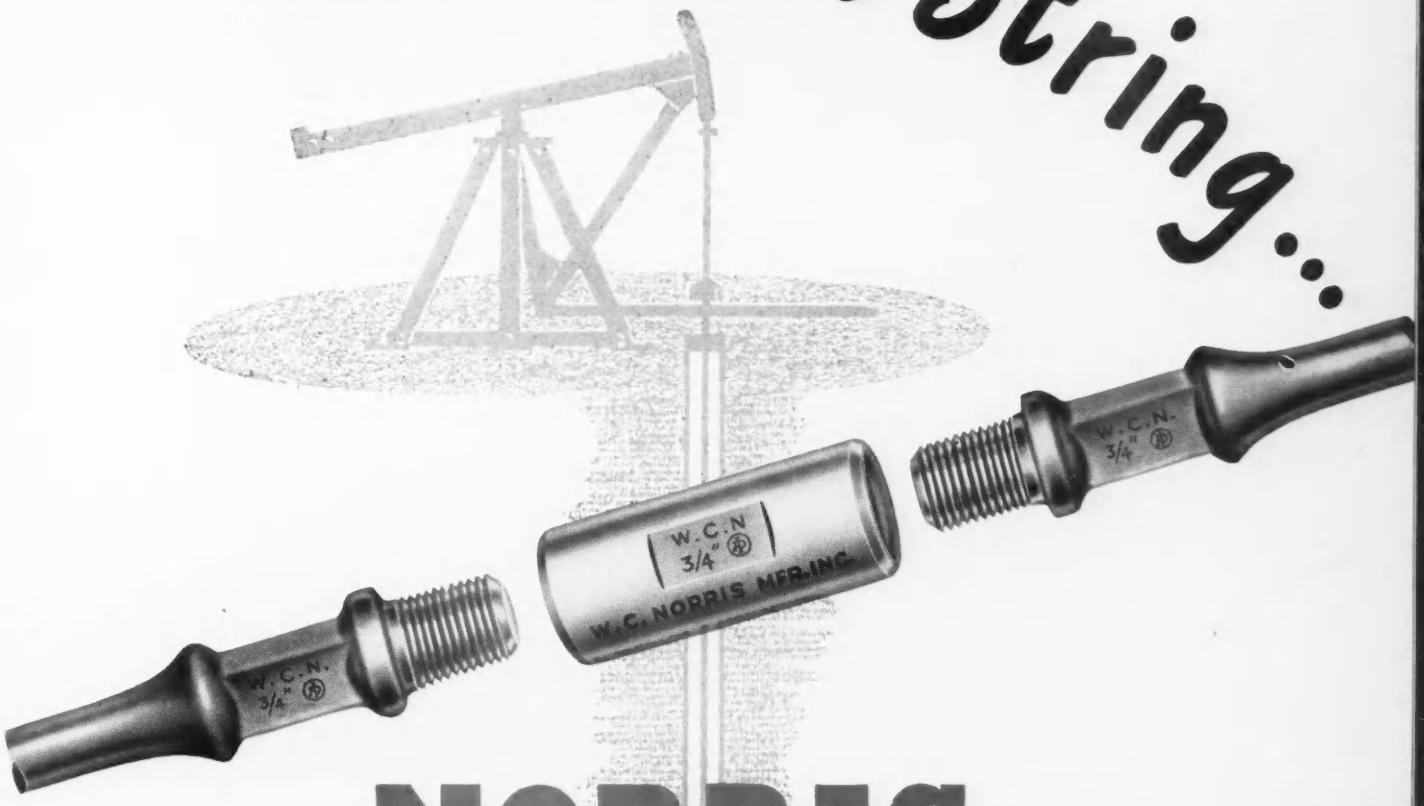
1. Cash payment of $7,250,000 by the company to the Kuwait sheikh.

2. Annual rental of about $650,000.

3. Royalty at the rate of $2.50 a ton, which on the basis of 33 gravity oil, is the equivalent of about 34 cents a barrel.

4. The Kuwait sheikh probably will participate in the operating company to be created, perhaps to the extent of 15 percent. This feature of the contract, it has been suggested, requires clarification

A Perfect String...



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because of overlapping interests of King Ibn Saud of Saudi Arabia, and may necessitate the formation of a third level holding company to administer the sheikh's interest in the program.

5. American Independent is granted full oil rights to the Kuwait sheik's undivided one-half interest in the Neutral Zone on the Persian Gulf, adjacent to Kuwait proper, an area which he holds jointly with King Ibn Saud.

Arabian-American Oil Company now holds preferential rights on obtaining a concession on Saudi Arabia's half interest. It is not known what discussions have been held as to agreement between American Independent and Arabian-American as to the operation of an undivided interest property.

Area Covered

The area of the concession comprises a desert territory with maximum length of 50 miles from east to west, and an average width of 45 miles. Although geologists have explored the region, no test wells have yet been drilled in the neutral zone. The company is sending geologists and other personnel there to proceed speedily and aggressively with the program.

Davies, who announced in London the acquisition of the concession contract for American Independent, said:

"In negotiating this concession American Independent feels that it has written a forward looking and significant chapter in the history of oil in the Middle East. It is the first time that a large-scale, adequately financed oil operation has been undertaken in the Middle East by independents. In Iran, Iraq, Saudi Arabia and the shiekhdoms of Kuwait, Bahrein and Qatar, billions of barrels of oil reserves and even greater potentialities that exist for the development of future reserves, are under the control or ownership of a few large countries or combinations of large companies in Great Britain, the U. S., France and Holland. Some of their concessions are so vast that only a fraction of their extent has even been explored.

"This situation was not, perhaps, a matter of critical importance so long as oil existed in surplus throughout the world and especially in the United States. However, with the transformation in this country from an era of oil plenty to one of shortage, and with the shift to dependence on foreign petroleum, the absence of a strong, independent element abroad raised an issue of immediate and direct interest to both the petroleum industry and the public generally.

"In the new world oil era that is upon us, it behooves the entire industry to adjust to the realities of the times. 'Competitive rivalry' and 'free enterprise' must not become mere words in the oil man's lexicon. If the petroleum industry, as we have always known it, is to survive, the independent must make every effort to find his place in world oil production."

Davies pointed out that in Kuwait, exclusive of the Neutral Zone, the Kuwait Oil Company, owned equally by Anglo-Iranian Oil Company (British) and Gulf Exploration Company (American), are operating what is probably the world's largest oil field—a vast reserve estimated to contain some 9 billion barrels of oil. This field adjoins on the north the territory on which the new concession has been granted.

Haifa Refinery Closed

Elsewhere in the Middle East the oil picture generally remained clouded because of resumption of Jewish-Arab warfare in Palestine. The British Embassy at Washington denied that London was seeking to aid the Arabs by keeping the Consolidated Refinery at Haifa closed. The Embassy pointed out that Iraq Petroleum Company, which controls the refinery, is not owned by the British government and that "the Haifa refinery was closed because of labor absenteeism which followed outbreaks of violence. The Jews say they could not provide sufficient labor to operate the refinery. But even if they were able to do so, that would not guarantee reopening of the refinery, as the flow of oil through the pipe line to Haifa could be stopped at any time by the Iraqi government."

Crude now reaching Haifa is being taken by tanker to Tripoli, Lebanon, and thence shipped for refining outside the Middle East. This does not increase the supply of products available to the Arab countries because the small Tripoli refinery operates to capacity on oil received direct by the pipe line from Kirkuk and does not process any of the oil tankered up to Tripoli from Haifa. Storage tanks at Haifa when conflict first opened held only two months supply for all Palestine at the normal consumption rate. At Jewish request no refined oil has been removed from these tanks for export since then.

Pipe Released

Steel pipe originally intended for construction of the trans-Arabian pipe line from the Dahran field to Sidon, Lebanon, has been released to the Tennessee Gas Transmission Company. The pipe, 30 and 31 inches in diameter, will go into the Tennessee Gas system which runs from the Mexican border in Texas to West Virginia. Freighters are taking the pipe from the docks in Long Beach, Calif., through the Panama Canal for unloading in Houston and Beaumont.

About 80 miles of steel pipe were involved in the first shipments. A total of 225 miles of pipe—64,000 tons—is to be shipped after manufacture at Consolidated Western Steel Corporation, Maywood, Calif.

Reasons for Diversion of Pipe

The diversion of the pipe by the Trans-Arabian Pipe Line Company, affiliate of the Arabian American Oil Company, followed refusal of export license for it by the Office of International Trade. The agency will again review export application in September. Political difficulties were among the factors which dictated refusal of the license. Aramco has been unable to obtain line transport rights from Syria after two years of negotiations, and Lebanon, terminal country for the line, is closely involved in the Arab cause in Palestine. It is reported that Aramco is considering re-routing the trans-Arabian line to terminate at the Gulf of Aqaba, on the east side of the Sinai Peninsula. This terminal would still require Suez Canal shipment unless the company brought the line across Sinai to the Mediterranean. This might be accomplished by an underwater line at Aqaba, although water lepths up to 2000 feet there indicate the difficulty of such a project.

If negotiations by Egypt for the extension of Egyptian territory through what is now the extreme southern tip of Palestine, are successful, then it would be possible to route the pipe line all the way from the Persian Gulf to the Mediterranean, via Sinai, through only Saudi Arabian and Egyptian territory. This arrangement depends on the concurrence of King Abdullah of Transjordan, who has not yet sanctioned the "through corridor" to the coast.

Negotiations are being carried on between the Superior Oil Company of Los Angeles and the Saudi Arabian Government for off-shore drilling rights in the Persian Gulf. Superior was one of the unsuccessful bidders for rights in the Kuwait Neutral Zone, along with Iraq Petroleum Company, Gulf, Burmah Oil Company and Shell. The Arabian continental shelf is believed to contain huge petroleum deposits.

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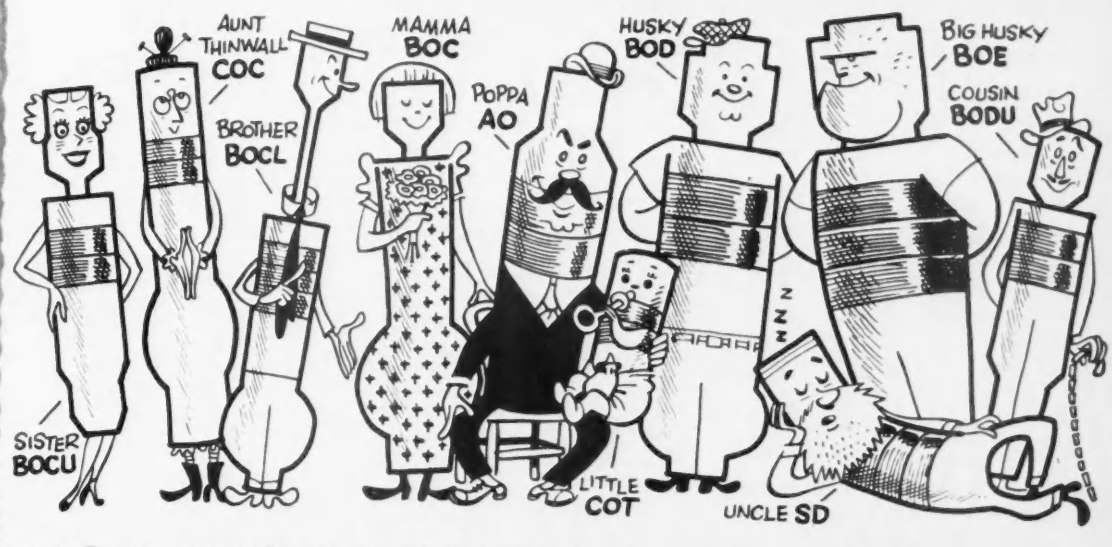

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COC— is a thinwall packer which gives casing-to-casing packoff where space will not allow the use of a standard packer, and is used for a wide variety of average-duty uses.

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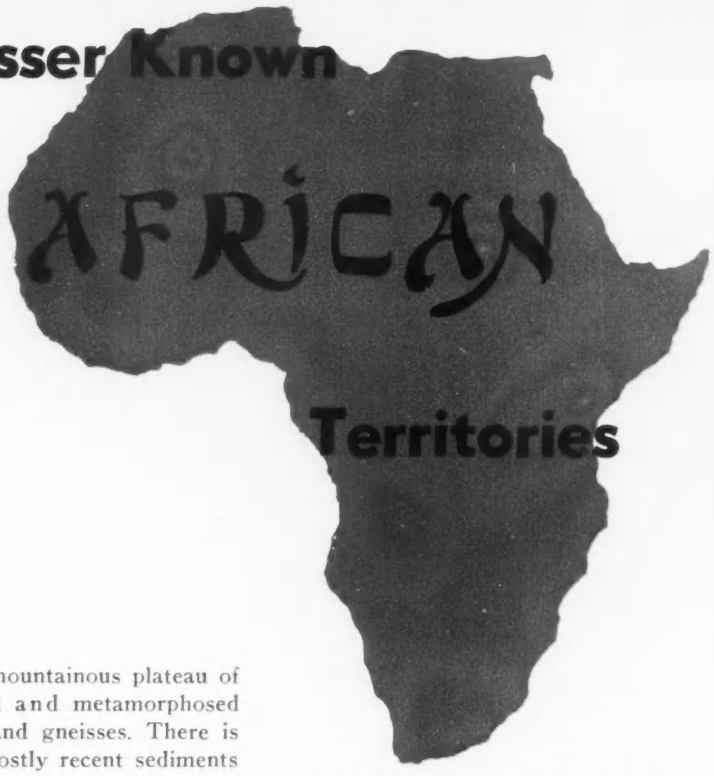
Oil Possibilities in Lesser Known AFRICAN Territories



ALTHOUGH the only important oil production in Africa is that from the fields in Egypt, with lesser amounts having been produced from Algeria and Morocco, most of the other areas have come under some degree of investigation for oil possibilities. In many of these regions the total activity has been limited to geological studies of general nature, plus some more detailed studies of sedimentary areas, but in others the investigation has included drilling of wildcat wells, some of which were deep enough to supply considerable information on geologic succession and stratigraphy. In some areas, such as Madagascar, wells have been drilled which actually produced small, uncommercial amounts of oil. Some regions have come in for attention from some of the major units of the oil industry and it is quite likely that these studies will be resumed to some extent within the near future, since previous prospecting activity has resulted in showings in most of them. This article reviews the known geological conditions and history of petroleum investigation in some of the lesser known territories of the African Continent.

Madagascar

In Madagascar exploratory work is being continued in the sedimentary formations on the west of the island. Earlier prospecting had suggested the possibility of obtaining oil by the distillation of bituminous sandstone, but this project was abandoned owing to high production costs. Five wells drilled in Madagascar before the war gave small quantities of very heavy crude oil. The flow of one of these at Tsimiroro amounted to as much as seven barrels per day. The French Government-sponsored Syndicat d'Etudes et de Recherches Petrolières has been carrying out extensive geological and geophysical work in this area.

Madagascar has been an island since the beginning of Jurassic times. It largely consists of a mountainous plateau of intensely folded and metamorphosed shales, granites, and gneisses. There is a thin band of mostly recent sediments on the east flank of the central massif and a wider band of sediments of Permian to Tertiary ages on the west side of the island. It is this western sedimentary area which is split up by igneous intrusions into a number of basins that are of interest for possible oil accumulations. Oil shows have been known on the west coast of Madagascar since 1887, generally as impregnations of the Morafenobe Triassic Sandstones.

Portuguese East Africa

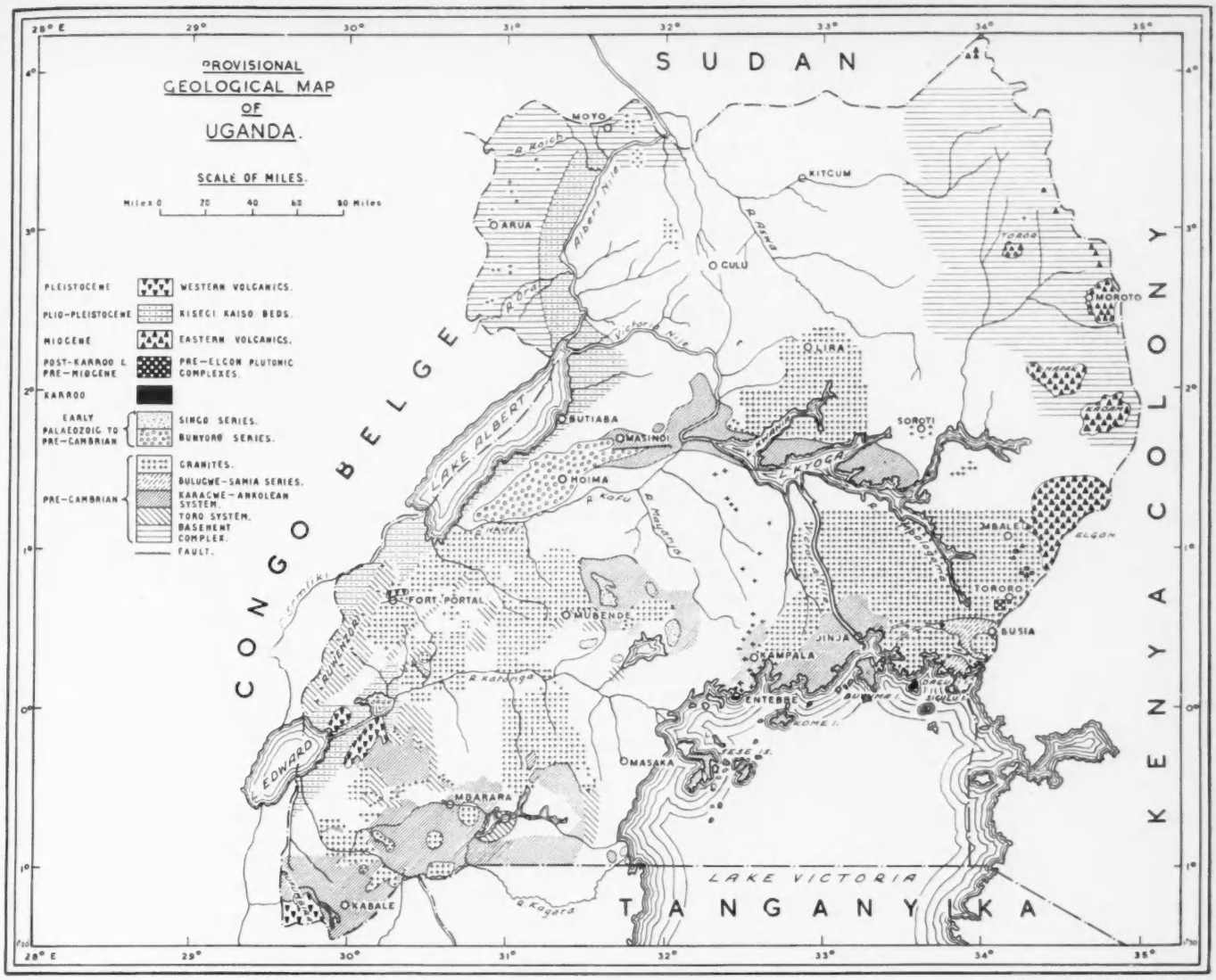
The oil shows in Madagascar arouse interest in the oil possibilities of the nearby territory of Portuguese East Africa where there is also a strip of sediments along the coast ranging from the Cretaceous to the Upper Tertiary. The Inhaminga Petroleum Company drilled five wells in 1934 on the Inhaminga anticline about 90 miles north of Beira, the deepest of which attained a depth of 8083 feet without success. As far back as 1905-1911 drilling was undertaken in the Lake Nhangela region of Inhambame district and found traces of ozokerite and pitch at depths of 800 feet, but these tests also were abandoned.

The concession held by the Manita Trust from the Mozambique Company expired in 1940, but further prospecting concessions for oil over a wide area of the coast of Portuguese East Africa have subsequently been obtained by the same concern, in which the Inhaminga Petroleum Company is a substantial shareholder. The Mozambique Company returned the Manita and Sofala territories to the Portuguese Government in 1942 and the responsibility for exploring the mineral potentialities of this vast territory now belongs to the government. Difficulties of transportation are the most serious obstacle in the way of full exploitation of the mineral resources of Portuguese East Africa, but the completion of the Tete railway and the extension of the line from Laurenco Marques to connect Umtali to Beira is expected substantially to reduce this problem.

Basutoland

Considerable efforts have been made in South Africa to find oil in commercial quantities. A number of deep tests have been drilled on the basis of small surface seepages, but none have achieved success. The origin of these seepages is probably the distillation of underlying coal seams by igneous intrusions. In the Coal Measures there are a few occurrences of impregnated sandstones, as for example at Danhauser in Natal. More frequently the "oil shows" take the form of amygdales in volcanic rocks which contain black hydrocarbons with the appearance of polymerized pitch.

In Basutoland similar occurrences of hydrocarbons in vesicles in igneous rocks have more recently been reported a few miles southwest of Notang and in the Liqobong stream. No liquid shows are known anywhere else in Basutoland. It is suggested that the oily material in the lavas of the Karroo system is brought up from below by the destructive distillation of the Carbonaceous beds in the lower Karroo by dolerite dykes. It is generally concluded that there is very little prospect



From Bulletin of the Imperial Institute, xlv, 2, 161, 1947, by K. A. Davies and C. Bisset.

of commercial oil deposits in Basutoland on account of the absence of liquid seepages, the continental nature of the sediments, and the unsuccessful drilling in neighboring areas of South Africa.

The general structure of Basutoland is a shallow basin and the rocks outcropping over two thirds of the territory are the Drakensberg beds, while the Stormberg sediments (Moltano beds, Red Beds and Cave Sandstone) cover the remainder of the territory. A number of low domes and basins result from the crossing of two sets of folds whose axes run in northeast and northwest directions. The local stratigraphy is as follows:

	Recent	Alluvium
	Quaternary	Gravels
		unconformity
	Upper Cretaceous	Kimberlite pipes and breccia
Karroo System (Trias-Rhaetic)	Karroo dolorites	
Stormberg Series	Drakensberg Beds (4500 feet)	Basalts and andesites
Stormberg Series	Cave Sandstone (100-1000 ft.)	Massive, fine-grained sandstone with thin shales
Stormberg Series	Red Beds (50-850 ft.)	Sandstone, shales and mudstone
Stormberg Series	Molteno Beds (100-500 ft.)	Grits, sandstones and shales
Stormberg Series	Beaufort Beds	Sandstones, shales and mudstone

The Uganda protectorate lies across the Equator in the center of Africa and has an area of 90,000 square miles. The local geological succession is as follows:

Pleistocene	Western Volcanics
Plio-Pleistocene	Kisegi-Kaiso Beds
Miocene	Eastern Volcanics
Post-Karroo and Pre-Miocene Karroo	Pre-Elgon Plutonic Complexes
Pre-Cambrian to Early Paleozic	Singo Series Bunyoro Series
Pre-Cambrian	Granite Bulugwe-Samia Series Karagwe-Ankolean System Toro System Basement Complex

The basement rocks which are found along the eastern, northern, and northwestern borders of the territory are composed of a series of metamorphic, volcanic, and plutonic rocks.

The Toro system is confined to the southwest quarter of Uganda and is composed of quartzite, grits, and schists. The Karagwe-Ankolean system provides the most important group of sedimentaries in the region. It also occurs in the Congo, Northern Rhodesia, and Tanganyika and has been tentatively correlated with the Witwatersrand System of South Africa. The dominant rock types are quartzites, conglomerates, sandstones, grits, shales, and mudstones.

The Karagwe-Ankolean system in the extreme southeastern corner of Uganda contains a higher proportion of volcanic material than elsewhere in the territory and has been differentiated into a lower Balugwe series and an upper Samia series.

The Bunyoro series of beds, which are of mainly glacial origin, succeeds the Karagwe-Ankolean series unconformably and is thought to be late Pre-Cambrian in age. Then follows the

Singo series of flat-bedded sandstones, siltstones, and shales.

There is a long break in the stratigraphical sequence at this point, since the Karroo beds which occur as three relatively small patches of shale and grits, are of upper Carboniferous-Jurassic age. Then follow a series of igneous complexes, mainly Miocene in age. On the west side of the Albert Rift there are a series of Plio-Pleistocene arenaceous sediments which cover an area of about five square miles and are called the Kisegi beds. One oil seepage has been reported from this series, which is overlain by a great thickness of Pleistocene Kaiso beds, mainly argillaceous bands.

The Karagwe-Ankolean system is the most important mineral-bearing formation. Tin, gold, wolfram, tantalite-columbite, phosphates, mica, beryl, amblygonite, and bismuth ore have all been produced in commercial quantities.

Marked magnetic anomalies have been found in an area in Buganda near the northwestern corner of Lake Victoria and in the Tororo area. The former anomaly was undoubtedly due to the rich local magnetite deposits, but the reason for the latter is unknown.

Seepages of both paraffinic-base and asphalt-base petroleum associated with gas have been recorded in the Plio-Pleistocene sediments of the Albertine Depression at Kibero and Kibuku. There are several interesting structures in this area, in one of which (the Waki Dome) a test-well was drilled by the Anglo-Iranian Oil Company in 1939. Oil in small quantities was found by this test, but circumstances caused the premature closing down of the operations.

It has been suggested that this test was not situated on the true crest of the dome and the Uganda Geological Survey intends to carry out further investigations, including test drillings to a depth of 2000 feet round the northern nose of Ruwenzori and on the Semliki and Kaiso plains. It is difficult to understand how compression folds have been formed in this area of structural tension.

Angola

In Angola, the Portuguese possession on the west coast of Africa, south of the Congo River, interest has recently been aroused in the possibilities of using the extensive local asphaltic deposits as a source of fuel. These deposits are in the form of seepages impregnating Binga (Cretaceous) sandstones and limestones, although there are also deposits of asphalt such as those at Gondo, northeast of Ambrizette, and at Dande, north of Loanda. The seepages extend throughout the greater part of coastal Angola and in the Cabinde enclave.

The Comasan Company has worked asphaltic sands commercially for several years in the Libongo area. The product is used for street paving in the main towns of Luanda and Benguela and some has been exported to Lisbon. During the war the local acute shortage of fuel resulted in the crude but successful distillation of the asphaltic sand to produce gasoline and diesel oil in sufficient quantities to meet the immediate demand. A second Portuguese company began prospecting for mineral deposits in 1947 and is proposing to make commercial use of the asphaltites (libolites) which are found locally in seams of up to five feet in width.

No further oil prospecting has been done since the exploration drilling of the Companhia des Petroles de Angola (a Sinclair subsidiary). This began as far back as 1918 and continued to 1932, by which year some 30 wells had been drilled to a maximum depth of about 5600 feet, all without commercial success although a few small oil shows were found. Most of the wells were drilled on northeast trending fold lines where the basement complex of crystalline rocks had been arched up by Miocene disturbances. The regional dip of the sediments is gentle, about 10 degrees westward to the Atlantic. These seepages may be related to the main fault between the coastal sedimentary strip and the Pre-Cambrian crystalline rocks that form the African shield.

Drilling Operations Stepped Up In Venezuela West Tarra Area

Colón Development Company has stepped up its drilling operations in the new West Tarra or Los Cerritos area of western Venezuela by moving in an additional rig. The company's W. T. 2, discovery well, is still producing at a rate of approximately 1500 barrels daily from at interval at 8820-9173 feet, and the two rigs will be operated in an effort to define the producing area. The second well in the new field, W. T. 3, was drilling at a depth of 9535 feet at latest report, very near the depth of the discovery well, and has already found that the upper interval at 6820-85 feet, from which the discovery well tested 2000 barrels daily, will not produce in this one-mile outpost to the north.

Early evaluation of this field is quite important, since a much better idea would be obtained of the potentialities of the Cretaceous Limestone formation here and perhaps would give an indication of what may be expected from the territory between Tarra and the prolific new La Paz and Mara limestone production.

Officials Urge Development Of Power Alcohol in India

The development of India's power alcohol resources is being urged in view of the deteriorating gasoline supply situation of the Dominion. The estimated annual prewar consumption of gasoline in India was about 2,400,000 barrels, of which domestic production accounted for about 17 percent, and imports, mainly from Burma, for the rest.

The Punjab oilfields are now incorporated in Pakistan, and the oilfields of Assam are the only source left to India. However, surveys are being made in Jodphur and elsewhere for potential new deposits.

The possibilities of producing considerable quantities of power alcohol from molasses and using this fuel in industry are being investigated. According to estimates, only 150,000 tons of India's annual output of 400,000 tons of molasses are being used in the production of rectified spirit, methylated spirit, etc., the rest being thrown away as waste. If sugar production were to be increased, as has been suggested, even larger quantities of molasses would be available for the manufacture of power alcohol.

It has been suggested that about 20 new distilleries should be constructed for the production of power alcohol from molasses, to be located mainly in the chief sugar-producing regions of the United Provinces and Bihar. The establishment of new and larger facilities might also help reduce the relatively high cost of power alcohol, which is at present about half a rupee a gallon.

Meanwhile, a ten-year plan for the development and exploitation of the mineral sources of Mysore has been prepared by the director of geology in Mysore for the consideration of the Indian government.

Apart from the economic minerals already being exploited, there are rich deposits of copper and magnesium minerals, as well as mica, kaolin, limestone, kyanite-sillimanite and ochres.

The government of India has now circulated drafts of its mining and petroleum concession rules. These are reported to specify that a "certificate of approval or exploring, prospecting, or mining license shall be granted only to a person who is an Indian subject," or, in the case of a company or firm, "only if such company or firm is shown, to the satisfaction of the government, to be controlled by Indian subjects alone or with foreign subjects, and registered, incorporated and established in India with rupee capital." The proportions of the latter subscribed in India shall be "not below 51 percent, with proportional representation of Indians in the directorate."

World Oil Export Center May Move to Middle East

THE oil export center of the world is expected to move from the Western Hemisphere to the Middle East, according to Sir William Fraser, chairman of the board of the Anglo-Iranian Oil Company, Ltd., in his recent report to company stockholders in London. Fraser said:

"One outstanding feature deserves remark, namely the public interest aroused in the importance of Middle East petroleum production, in which this company plays so large a role, to world economy. The Western Hemisphere's consumption of oil products is now overhauling even the huge petroleum production of the Americas and the world at large looks increasingly to expanding exports from the Middle East to satisfy its needs. Europe in particular will depend mainly on the Middle East for oil supplies and this has recently brought to public attention what has been obvious to the petroleum industry for some years past, that the oil center of the world is likely to move from the Western Hemisphere to the Middle East."

Fraser reported that crude oil production in Iran during 1947 was 20,194,838 tons, which, at the conversion rate of 7.56 barrels per ton for Iranian crude, averages just over 421,000 barrels a day. The four main fields of Haft Kel, Agha Jari, Masjid-i-Sulaiman, and Gach Saran contributed the bulk of this production, Haft Kel alone producing nearly half the total. "Development there is proceeding steadily," says Fraser, "both of the productive system and of housing and other amenities necessary for employees."

In the Lali area further structural information has been obtained by drilling and production arrangements proceed satisfactorily, the company reports. The Naft-i-Shah and Naft-i-Safid (White Oil Springs) fields contributed their quota to production, "but investigation of the latter area is bearing out the forecast made in 1939 that its reservoir, though important, is relatively small."

Fraser says that test drilling and geological and geophysical exploration for other oil-bearing structures is continuing in Iran.

The Abadan refinery set another record by processing 18,565,507 tons (140,355,232 barrels) for 1947, the largest annual throughput ever achieved. "Our smaller refineries at Kermanshah in Iran and Alwand in Iraq have operated satisfactorily during 1947 at slightly higher levels than in 1946," Fraser reported.

Anglo-Iranian spent approximately $16 million in 1947 on housing projects, health services, health and education work, and recreational activities in Iran. Fraser adds that Anglo-Iranian's relations with the Iranian Government "remain excellent."

Anglo-Iranian has pushed the hunt for oil in other parts of the world but reports no positive indication of commercial quantities has been found. In Papua a test well was completed at a depth of 12,621 feet. In the Bahamas negative results were obtained in drilling, geological, and geophysical work, and Fraser reports "prospects do not appear to be good." In Australia two companies in which Anglo-Iranian has a third interest each formed a partnership with the Zinc Corporation and Vacuum Oil Company Proprietary, Ltd., to test possible oil areas, and geological work is under way. Exploration activity in India and Pakistan has continued.

In England, the company reports production at its Eakring field declined in 1947 to 47,200 tons, (351,168 barrels). But other areas are being tested and geophysical surveys are in progress.

Refinery Report

Fraser reported: "Our refineries in the United Kingdom have operated satisfactorily throughout the year. Llandarcy processed 450,537 tons (3,333,974 barrels) in 1947 as against a normal capacity of 360,000 tons, (2,664,000 barrels), this increase being due to operating adjustments which will step up capacity during 1948 to the rate of 850,000 tons (6,290,000 barrels) per annum; this figure is scheduled to rise to 3 million tons (22,200,000 barrels) per annum by the end of 1949 when the full expansion scheme for this refinery is completed. Grangemouth refinery operated at its normal maximum capacity of 360,000 tons (2,664,000 barrels) per annum, which will be raised to the rate of 600,000 tons (4,440,000 barrels) per annum in the current year. We have planned to increase this figure to 1½ million tons (11,100,000 barrels). In addition to these big increases in our two existing United Kingdom refineries, it is our intention to construct a large new refinery in Kent."

German Hydrogenation Works To Be Used to Process Crude

The Bipartite Control Office has issued a permit to use unemployed German hydrogenation works for the processing of residual crude within the framework of the oil import program. This decision is important in two respects: the prohibition of the hydrogenation process imposed on the basis of the Potsdam agreements has now been cancelled in the western zones, and some efficient plants are now again at the disposal of German fuel economy, which, together with the acutal oil refineries, will be able to absorb and process the oil to be imported into Germany under the oil plan in years to come.

The planning of the Allied and German authorities had hitherto been obstructed by the fact that the number of plants available for the processing of the residual crude was not sufficient, though the west-German refineries possessed a sufficient topping-distillation capacity for the first processing stage, the recovery of about 50 percent of light products from the crude. After the release of the hydrogenation works it will be possible to hydrogenize the residue by means of the high-pressure process, thereby again recovering gasoline and gas oil. Processing of the residue for gasoline will probably yield a recovery of 77 to 79 percent.

The Rhenish works of Wesseling and Gelsenberg will be the first to be considered as crude oil processing plants. An agreement recently was concluded between the Union Rheinische Braunkohlen Kraftstoff-A. G. and the Deutsche Shell A. G. under which the Wesseling works will for the present, furnish a topping-distillation capacity of 2½ million barrels, later 5¼ million barrels of crude yearly. This agreement will also apply to the hydrogenation of the recovered residue. Wesseling will probably be able to hydrogenize 1¼ million barrels yearly. At Gelsenberg this hydrogenation capacity will be doubled. It is explicitly pointed out that the present monthly production of 5000 tons of ammonia at Wesseling, as well as the production of 3000 tons of methanol, will be left untouched by the use of the works for the refining of crude.

Moreover, the permit issued by the Bipartite Control Office concerns the total operation of all German refining plants as suggested by the German and Allied authorities and technical associations. Accordingly, it also applies to the resumption of operations at the refinery and cracking plant of the Eurotank at Hamburg-Finkenwaerder, in addition to the hydrogenation works at Wesseling and Gelsenberg.

SHELL Reports Production Gain in 1947 Sees Growing Near East Importance

TOTAL production during 1947 for the Royal Dutch Shell group, covering operations in 14 countries, amounted to 274,985,000 barrels, according to report recently issued by the Royal Dutch Shell Company for the Working of Petroleum Wells in the Netherlands Indies. This production figure is against 229,615,000 barrels for 1946. The quantity of crude produced by the group outside the U. S. increased 24 percent over that of 1946. The report says:

"The considerable increase in the demand for oil products in the Western Hemisphere will lead in years to come to great changes in the world's oil supplies, in such manner that the Near East will, for the greater part, take over the supply of those parts of the Eastern Hemisphere which hitherto acquired their products from the Western Hemisphere.

"Whether this transition from West to East will be a success will largely depend on whether favorably situated refineries will be available in the Eastern Hemisphere to process the production of the East.

"While in 1946 the Western Hemisphere still provided 77 percent of Europe's import requirements and the Near East only 23 percent, estimates show that in 1951 Europe will have to meet 80 percent of its requirements of petroleum products by imports from the Near East."

Future Program

Commenting on its future program resulting from the agreement signed last year with Gulf Exploration Company, a subsidiary of Gulf Oil Corporation, the group says:

"The Gulf Exploration Company owns 50 percent of the shares in the Kuwait Oil Company, Ltd., which company owns concessions in Kuwait, on the north side of the Persian Gulf. In 1948 and subsequent years, the group will acquire important and increasing quantities of crude oil which it will be able to dispose of in the Eastern Hemisphere via its refining and distribution organizations. This makes it necessary for the refinery of the Bataafsche Petroleum Maatschappij in Pernis (Rotterdam) to be considerably extended, and for two new refineries to be built by the group in the United Kingdom, one on the Thames and one on the Manchester Ship Canal."

Shell sees no signs whatever that the rising tendency, shown by the consumption on the North American continent among other places, will fall off. This would mean that "the existing U. S. tanker tonnage will be more and more employed in the service of the American economy itself, probably involving larger voyages, perhaps to the Near East, in order to ship from there crude oil and products to supplement the quantities available from the Western Hemisphere. The fact that the market cannot be entirely satisfied at present is very largely due to the shortage of tankers. The development of the petroleum industry is thus dependent to a considerable extent on the scheme for the building of new tankers and the magnitude of this program necessitates an important part of it being carried out in the U. S."

It estimates new investments outside the U. S. and European countries which the company will make through 1949 as:

Crude oil, exploration, pipe lines	34%
Tankers	9%
Refineries & Chemical factories	41%
Distribution facilities	16%
	100%

At the end of 1947, total capacity of the group's refineries outside the U. S. amounted to 208 million barrels per year, an amount which will be raised to 257 million barrels by the end of 1949.

Influence of Steel Shortage

The report sees the shortage of steel as the one factor most directly influencing the availability of petroleum to meet the enormous potential demands of the next few years. Steel will make its influence felt on all the facets of the industry, such as drilling activity, pipe line construction, and the building of refineries and tankers. For some time to come Shell anticipates an enormous demand for petroleum products which cannot be entirely met, either as a result of a shortage of the products themselves, or in consequence of transportation difficulties.

Commenting on European demand projected to 1951, the Shell report says: "The consumption of energy and in particular the consumption of petroleum products per head of population plays a much less important role in Europe than in the U. S., as will appear from the estimates for 1951, in which all forms of energy are expressed in equivalent quantities of coal and afterwards totaled. For that year the European consumption of energy per head is estimated at the equivalent of 2.52 tons of coal, of which 0.29 tons is in petroleum products, as against 8.09 tons in America, of which 3.1 tons is in petroleum products."

The Royal Dutch Company goes on record in this report as favoring controls on ERP dollars so as to prevent the companies receiving aid from competing with each other when making purchases. The company thinks the proper method would be, within the framework of the Economic Cooperation Act, for each country to obtain allocations from a dollar fund, the allocations to be placed at the disposal of importers in the country concerned, who will have to see to it that the petroleum products become available through the normal channels. It has already become known that for the application of "Marshall aid" the American authorities will make as much use as possible of private channels.

Worldwide Operations

In regard to worldwide operations, much encouragement was drawn from the extent to which rehabilitation has progressed in many areas, notably the Far East where, although many areas, remain inaccessible, it has been possible to restore producing and refining operations in some regions to prewar level or greater. In British Borneo the Seria field increased its production to more

than double its prewar output, and most refineries which could be reached for reconstruction or rehabilitation have been placed back on stream, many exceeding prewar rates of operation.

The company is looking toward increased availability of crude oil from the Middle East, both through its contract for crude supplies with Gulf and from increased oil to be made available by pipe line construction now under way from Iraq fields, where the group owns a 23.75 percent interest in Iraq Petroleum Company.

In Venezuela the developments in the Cretaceous fields at La Paz and Mara in the western part of the country are leading to continued production rises, and much hope is held for further increases from the Tarra area where a new Cretaceous field is under development. Despite difficulties of obtaining materials for the stepped-up operations in Venezuela, and increased labor costs, it is thought that increased production will offset these difficulties.

The following figures show the worldwide scope of the group's operations:

Royal Dutch Shell Group Production

	1947 Barrels (in thousands)	1946 Barrels (in thousands)
Venezuela V.O.C.	94,310	77,032
Venezuela C.P.C.	22,223	16,689
Venezuela Colon	4662	5705
Venezuela N.O.M.	17,351	16,521
Total for Venezuela	138,546	115,947
U.S.A.	76,705	70,473
British Borneo	12,970	2050
Egypt	9300	8940
Iraq	7557	7625
Roumania	7756	9223
Netherlands Indies	6767	2100
Trinidad	5102	5121
Colombia	4780	3209
Argentina	3930	3841
Netherlands	739	218
Austria	619	618
Germany	214	250
Totals	274,985	229,615

Crude Production in May Brings Iran Total to 71,234,250 Barrels

Production of 16,843,680 barrels of crude from Iran's fields during the month of May brought the total output for the first five months of the year to 71,234,250 barrels, a rate which if continued would result in an increase of more than 10 percent in 1948 production above the 1947 figure. With current construction to make more crude available to shipping points it is anticipated that still further increases will be effected by the end of 1948 or early in 1949.

Production from fields in Iran, operated by Anglo-Iranian Oil Company, Ltd., during the first quarter of 1948 amounted to 39,361,280 barrels. Total for the month of March, 1948, was 13,744,920 barrels, as compared with February's 12,047,160 barrels.

Revised figures for Iran production during 1947 indicate that the six fields produced a total of 154,288,562 barrels of crude. Anglo-Iranian's production from fields in Great Britain during 1947 amounted to 360,608 barrels.

Phillips Petroleum Company To Begin Drilling in Leduc Field

Phillips Petroleum Company will become the first large American company actually to drill in the Leduc field, Canada, when it starts drilling on a quarter-section lease in Woodbend Township, Alberta. The lease was obtained from the Crown earlier this year and the company has let contract to Northern Development Company of Lloydminster for the drilling. The well is an outpost both to Leduc proper and to the Woodbend area, being a mile north of the nearest Leduc production and about 2½ miles east of Woodbend production. Standard Oil Company of California is another American company holding property in the Leduc field, having obtained a lease some time back in the producing area, but no drilling has been done.

Gulf Oil Corporation Begins Exploration in East Africa

Gulf Oil Corporation, through its subsidiary, Mozambique-Gulf Oil Company, is starting preliminary work on its exploration of a 45,000-square mile grant in Portuguese East Africa. First step will be an airborne magnetometer survey made in conjunction with a complete aerial mapping of the area from which geological interpretations can be made and coordinated with the magnetometer work. The plane reached Lourenco Marques, to be used as a preliminary base, late in July and is scheduled to start operations immediately. The survey by air is expected to take from six to 12 months, depending on the flying weather encountered.

Shell Group Abandons Fifth Test on San Martin Concession

The Shell Group has abandoned its fifth test on the San Martin concession in the Llanos region of Colombia. The San Martin 5 was drilled to 7996 feet as the deepest well in the series, but did not yield any showings of commercial value. The second well drilled some showings of heavy oil, but a series of tests in the original and in the sidetracked hole failed to prove the showings capable of producing.

The company has not indicated whether it will continue operation of this concession, which has been an expensive project. The problem of supply has been magnified by its position on the eastern side of the Andes mountains.

El Roble Field in Venezuela Extended West 1300 Yards

The El Roble Field of eastern Venezuela has been extended an additional three-quarters of a mile to the west with completion of Creole Petroleum Corporation and Pantepec Oil Company's Roble 17. This step-out completes an extension of a mile and a half to the west in recent months, since it is 1300 yards west of the Roble 11 which extended the field a similar distance during 1947. Also late in 1947 Roble 12 was completed as a successful step-out 1300 yards north of the previous northernmost production.

Wells in the area are completed at depths ranging from 8500 to below 10,000 feet, and one present operation, Roble 15, is now preparing to test Merecure sands after drilling to 11,852 feet. Most of the production in the group of fields in which Roble is situated produce from various members of the Oficina sand of the Miocene and Oligocene, while the Merecure, which has never been tested on regular production underlies the Oficina formations. The deep wells in Roble field are characterized by production of high gravity, high paraffin oil under extremely high pressures. Recent completions have produced at rates of from 1225 to 1400 barrels daily, initial production.

First Crude From Saudi Arabia Arrives at Tide Water Refinery

During the middle of July, Tide Water Associated Oil Company received at its Bayonne, N. J., refinery its first cargo of crude oil from Saudi Arabia. The crude was transported from the Persian Gulf in one of the company's T-2 tankers, which carried a capacity load of approximately 120,000 barrels to be used for experimental refining purposes and to supplement the supply of domestic crude. A decision on the company's plans for regular imports from this source will probably follow the processing of this first shipment.

New Field in Saudi Arabia May Be Major Discovery

The new field at Ain Dar in Saudi Arabia, discovered by Arabian American Oil Company, probably will be a major contribution to world oil reserves, in the opinion of an official of the company at San Francisco.

The field begins 27 miles west of the prolific Abqaiq field and probably will extend over a large area to the west, being on an anticline that extends 125 miles westward.

In the new field a well is now down to 6900 feet, with 250 feet of oil sand and large flow of production.

Mexico Has First Big Oil Discovery In Ten Years

MEXICO'S only substantial oil discovery in the last ten years is reported at Reynosa Well No. 1 in the State of Tamaulipas, just south of the Rio Grande river. This well, which came in May 6, is not only the first discovery since the expropriation of American and British interests in 1938, but it is the first oil producer between the Rio Grande and Tampico and opens a whole new field and area of the country.

Information concerning the well is still incomplete and rests on the Mexican Government's announcement together with some supplemental data furnished by U. S. consular attaches. It is known that the well penetrated 42 feet of gas-impregnated sands at 6318 feet with high pressure through a ⅜-inch choke. Oil-productive sand was first encountered at a depth of 4500 feet where the gas flow was reported at 500 pounds pressure for 12 minutes through a ¾-inch intake.

Results of tests on the well are not available, but some observers say a 10,000-barrel-per-day flow is likely. When the well came in, oil gushed out over the top of the casing and sprayed the surrounding acreage. The crude is reported to be high grade.

Well Location

The well location is five miles southeast of Reynosa, which is just about 50 miles east of Brownsville in wildcat country. The structure is believed to be continuous with land north of the border where testing is expected to follow quickly. Reynosa No. 1 was drilled by the Mexican state petroleum monopoly, Petroleos Mexicanos (Pemex), which is now conducting four other tests in the area. Two recently-discovered gas fields are in the region, Mision and Camargo. Pemex has spudded in Camargo No. 8, expecting to go to 3000 feet, and has rigged up at Camargo No. 9. Rhodes and Sullivan, Inc., of Abilene, Texas, is drilling in the area east of Reynosa under an 11,000-foot one-well contract.

Reynosa No. 1 will supply gas to Monterrey. The 35-mile gas line connecting wells in the Mision and Camargo fields with the Monterrey international gas line at San Pedron de Roma is nearly completed and construction is to begin on gas processing tanks at the field.

Meanwhile, The Texas Company expects to sign shortly its contract with Pemex, following but considerably different from the arrangement already made with Pemex by Cities Service Company. It is known that the pending Texaco contract provides for a loan by the company to Pemex amounting to $30 million for the construction of refineries and other projects. Pemex is to call on the funds progressively as the needs of the Mexican enterprise develop. Early part of the work includes reconstruction of the refinery at Minatitlan and the building of a new refinery on the Pacific Coast, probably at Mazatlan, to supply the northwest Mexican states. Also scheduled for early work are the laying of oil pipe lines and other installations.

The Texaco deal is expected to be the largest oil project ever slated by Pemex; even the $50 million Export-Import Bank loan, which is larger in total bulk, is smaller in respect of its specific assignment for petroleum projects.

Provisions of Loan

According to advance information the Texaco loan will have the following unusual features:

1. The Texas Company will grant the credit without asking in exchange for any concession for future activities.

2. There will be no physical guarantees and hence none of the Pemex properties will be involved or mortgaged.

3. The interest rate will be set at 3 percent per year, the same as that of the Export-Import Bank.

4. The loan will be amortized with oil over a five-year period. During that term Pemex agrees to deliver to The Texas Company no less than 3 million barrels of oil a year until the capital and interest of the loan are paid. The oil for these shipments, it is understood, will not come from Poza Rica nor any other zone now supplying domestic requirements, but will be heavy Panuco crude.

The arrangement will enable Mexico to solve some serious problems, such as the supplying of gasoline in its northwestern states, which have long been served from the U. S. under a contract between Pemex and the Standard Oil Company of California. With the establishment of its Pacific Coast refinery, Pemex indicates that such importation will no longer be necessary.

A further indication of improved relations between Pemex and the U. S. was seen in the recent testimony of Newton Foster of the Office of International Trade before the House Interstate and Foreign Commerce (Wolverton) Committee. Foster reported that Pemex was very cooperative now in furnishing OIT with details of its program in connection with licenses for steel exports. This represents a reversal on Pemex's part, said Foster, and observed that the new policy shows a friendly attitude to U. S. interests planning re-entry into Mexico.

Burmah Oil Company Drilling Two Deep Wells in Pakistan

In Pakistan oil activity is being carried on by the Burmah Oil Company, now drilling two deep wells at Chakwal, West Punjab, and Lakhra, about 170 miles from Karachi in Sind Province.

In addition to these tests it is proposed to drill wildcat wells in Eastern Pakistan at Patharia, in territory which now forms a point of dispute between the governments of Pakistan and India, and at other locations in the Sylhet and Chittagong districts of East Bengal.

The Attock Oil Company has announced production for 1948 up to the beginning of June was 182,184 barrels. Total output in 1947 was 330,082 barrels. The company's field work has been hampered by the exodus from Pakistan of Hindu and Sikh artisans and clerks as well as the dislocation of the railways.

At Balkassar the third well has been deepened further into the limestones and results of recent acidizing at increased depths are promising. The fourth well has been drilled to 4769 feet. Site for the fifth well is being prepared.

Eight miles of the new pipe line from the Balkassar field to connect with the existing Dhulian/Rawalpindi line have been laid and welded, despite extremely difficult conditions. Progress has been good recently and it is anticipated that the line will be completed in the second half of the year.

At Meyal the third test has reached a depth of 7500 feet, but structural conditions in this area continue very complex and so far developments have not come up to expectations.

The government of Pakistan has decided to alter the present act and rules governing the search for and production of petroleum and generally to follow the British Colonial rules governing such matters. The Attock Company has been given the opportunity of presenting its views regarding the Rules to the department concerned and negotiations are proceeding in a friendly manner.

The Attock Company is cooperating with the government of Pakistan in an effort to meet the Dominion's urgent need of oil products. There are difficulties to be overcome with regard to settlements between Pakistan and India.

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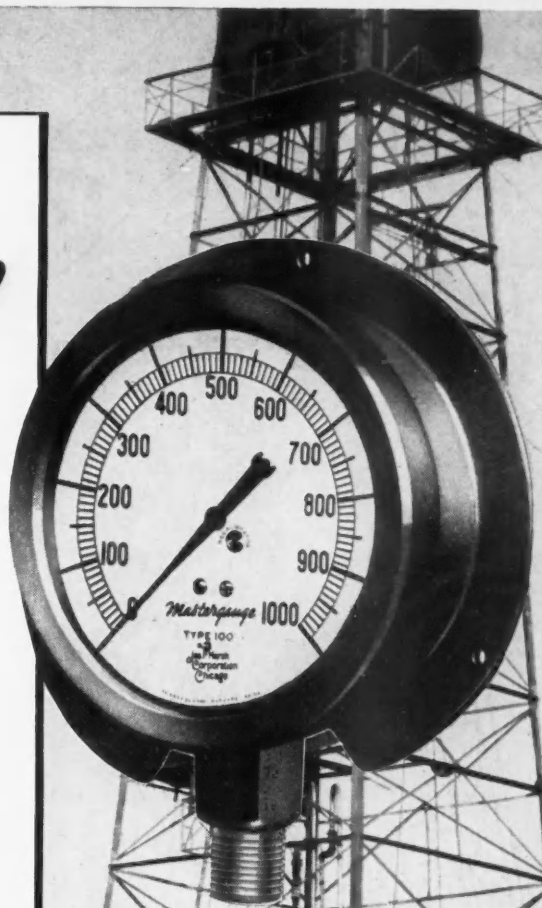

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but these are expected to sort themselves out once the problem of Kashmir is settled.

Completion of the pipe line to the Balkassar field will enable handling of increased production which it is expected will then be available from wells now in the course of drilling.

New Minister of Petroleum May Be Named for Colombia

Recent reports from Bogotá presage a possible shakeup in the Colombian cabinet which may include installation of a new Minister of Petroleum. Dr. Aragón, the present Minister of Petroleum, is expected to take his post as Senator, and there is a possibility that one of the members of the present National Petroleum Council may be appointed to the post as minister.

Of considerable encouragement was a recent statement by Aragón to the effect that the administrative legal procedure in connection with oil and mining matters was too involved. He warned of the danger of retarding important Colombian oil developments through constant proposal of new oil bills and uncertainty as to governmental oil policy. He recommended that due study be given to the proposed new oil bill and that a firm policy be established once and for all.

Roumania Formally Completes Nationalization of Its Industry

With a bill adopted by the Roumanian Cabinet in June and passed unanimously by the Parliament, the government of Roumania has formally nationalized nearly all of its industry. This is an aim which has been in the background ever since the country came under Soviet influence. The new measure nationalizes most of its general industry, plus all railways, telephone and radio systems, mines, oil wells, and other natural resources. It is understood that compensation is to be paid out of state bonds from the newly-created "fund of nationalized industry."

All oil companies with the exception of the Sovrompetrol firm are being formally taken over by the Roumanian government. Sovrompetrol, including the interests taken over as reparations, enjoys immunity from nationalization, although it is essentially a state-owned company. It has been diverting a considerable share of Roumanian production to the U.S.S.R. The Association of Roumanian Oil Industrialists, the established and most representative voluntary organization of the petroleum industry, has been dissolved.

Meanwhile, it is reported that a British subject who has been representing British and French groups in the Steaua Romana Oil Company was arrested by police at the frontier when leaving Roumania to report to London for a consultation. At latest report he was still being held, and although he had been returned to Bucharest, the British consul was not allowed to visit him, nor had the nature of the charge been divulged.

Exploration Likely to Follow Recent Bavarian Agreement

Late in May a conference between representatives of almost all of the companies operating in Germany and representatives of the State Mine Office in Munich resulted in a fundamental agreement on the general distribution to be made of oil concessions in the Bavarian foothills region. As a result it now seems likely that a concentrated exploratory effort is to be started within the near future.

It is most likely that Bayerische Mineral-Industrie A.G., a Socony-Vacuum subsidiary, will be granted the greatest share in the areas involved, with strong participation by the Gewerkschaft Elwerath and Preussag companies. For a number of years these companies have been carrying out exploratory work in Bavaria. The greater part of the leases of the BMI will extend over large areas north and south of Ammer Lake as well as the area between Landshut and Wasserburg on the middle and lower Inn and on the lower Salzach.

A combination of the Gewerkschaft Brigitta (Shell and Standard Oil) with Gewerkschaft Elwerath and the Wintershall company is to have an extensive concession in the area between the Iller, Lech, and Danube, around the town of Augsburg. A narrow strip on the Iller was allocated to the Schachtbau & Tiefbohr A.G. The Deutsche Erdoel A.G., which is drilling a well near Bad Toelz, will get a concession including Munich and the surrounding area as well as the area between Tegernsee and Chiemsee.

The Itag company is to have a concession in the area of Freysing-Neuburg and Preussag will have an area south of the Danube between Ingolstadt and Passau.

Of particular interest regarding the possibilities for oil in Upper Bavaria and Upper Suebia are the statements of Professor A. Bentz, director of the German office for mineral research, which included the following:

"When judging the molasse syncline, which is interesting with regard to the search for oil, from the standpoint of petroleum geology, one should not only consider the small German share between the Ammersee and the Lake of Constance, but also the total geological unit of this syncline hollowed out by the front of the Alps and extending from Bruenn, Czechoslovakia, to Geneva, a distance of 560 miles. Already a number of small oil reservoirs, without any commercial importance, have been discovered near Bruenn, Leoprechting, and Tegernsee, while oil traces in the molasse beds are quite frequent in Switzerland. Therefore, there is no doubt that oil has formed in this large depositional basin, and the problem is concentrated upon the question of whether the amount will suffice to form major exploitable reservoirs.

"It must be stated in this connection that the exploration of Tertiary depressions of similar structure such as the graben of the Upper Valley, the Viennese Basin, and the Hungarian Basin, has led to quite a considerable practical success in the last decade. It must be emphasized that there is no fundamental difference between the geological structure and development of this molasse syncline and the other areas already proved as commercially oil-bearing; on the contrary, the molasse basin is comprised in the number of all these oil provinces with regard to its structure and age. One could be of the opinion that the small oil fields hitherto discovered have nothing in common with the molasse syncline and that the oil developed in the original basin of the flysch further south. The geophysical results show that the molasse basin has a rather asymmetric structure as have almost all of the depressions in the foothills. Its deepest spots are located immediately on the margin of the Alps, so that the thickness of the oil-bearing beds of the Tertiary considerably increases in the north-south direction.

"The oil prospect of that basin should not be made to depend upon the question of whether or not normal anticlines occur in it. Some examples of similar foothill depressions in Roumania and Eastern Venezuela show that overthrusts and fault zones which have already been proved in the molasse basin also furnish structural prerequisites for the accumulation of oil. The prospects of the oil search in the foothills of the Alps have undoubtedly improved through this new information."

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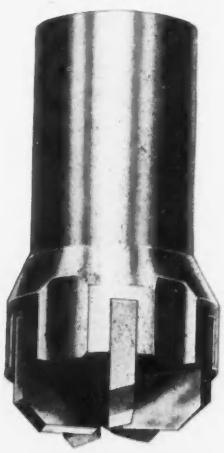

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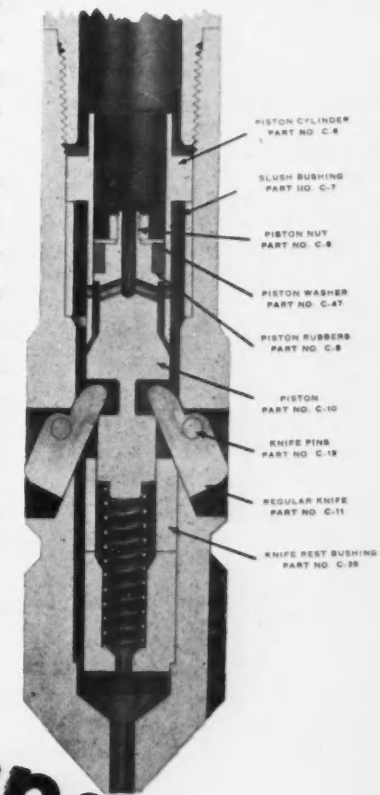
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Russia's Five-Year Oil Plan Goes on Four-Year Basis

Oil has become such an essential factor in Russia's program for her future economy, both military and civilian, that the Soviet Union has stepped up its petroleum development from a five-year to a four-year basis. The Soviet petroleum industry has made a declaration to Stalin that it will fulfill its five-year quota in twelve months less than the originally scheduled period.

The currently accelerated program is linked to the "exceptionally important discovery of oil in the Devonian strata in the Eastern districts." The Soviet publication "Pravda" says "the exploitation of these Devonian deposits, the search for oil in new areas, and the development of drilling in Bashkiria, Tataria, the Volga region, and Central Asia, have insured that the oil industry of the East will soon become an important producer."

"Pravda" further states that production and refining rates in the Eastern areas of Russia are growing steadily. During the last two years, it is claimed, oil production here has increased two and a half times over that of 1945, and drilling has almost doubled. "Pravda" says: "This year the production of oil in the Eastern districts will exceed the prewar level by two and a half times."

Many important technical and organizational problems relating to both production and refining were solved in 1947, Russian industry sources claim; particularly in drilling and machine building. For instance, the heavy "Vostok" caterpillar trucks were designed in 1947 for transporting heavy oil equipment and pipe and are now proving highly successful. "Drilling assemblies and cementing aggregates mounted on 'Vostok' trucks were devised by the engineers Arzumanov, Kopysitsky, Osipov and Lokotnikov," "Pravda" reports. "At the present time these aggregates are undergoing plant and industry tests. Our builders, together with workers of the Verkhneserginsk factory have almost tripled the output of drilling bits, and have also improved the quality of their product."

Russian engineers claim that the installation of hoist mechanisms on caterpillar tractors will make it possible to modernize and mechanize all operations in pipe-laying in ditches, in loading and unloading equipment and material, and in other heavy work. The factories managed by heroes Yelyan, Muzrukov, and Bykhovsky "have extended important assistance in supplying the oil fields and drilling operations with new equipment, instruments and machinery."

A large oil refining and machine building base has been established in east Russia, resulting in the doubling of the output of gasoline over 1940 totals, and a 150 percent increase in the output of factory products for the construction of oil machinery. "Because of this," claims M. Yevseyenko, Minister of Petroleum for the Eastern District, USSR, "technical standards in the oil industry for the Eastern regions have been raised immeasurably by the introduction of new techniques and perfected technology. But the most valuable and important result is the creation of qualified working cadres of engineering and technical workers. Five to seven years ago there were no experienced drillers in the Eastern regions, no machine operators. Thousands of qualified workers, technicians and engineers have been trained."

Outstanding Geologists

The Russian Institute of Sciences lists the names of "many outstanding geologists who have been developed in the last few years," including Trofimuk, winner of the Stalin Prize; Maltsev, Zoloyev, Mustafinov and Zubov, all of whom aided in the discovery of large oil reserves in Bashkiria, Tataria, the Kuibyshev region, and Uzbekistan. Drilling experts named are Balabanov, Kupriyanov, Alekseyer, Rakov, Nazarov, Gikalo, and others.

The effort to complete the Soviet Union's five-year petroleum plan in four years will "involve the utilization of all intra-industrial resources and the mobilization of the creative initiative of the workers and engineering and technical personnel." As a result of the achievement, it is said, Russia will receive "3.6 times more oil in 1949 than the enterprises of the eastern districts furnished in 1940."

The Russian Government regards drilling as the key to this program and says "the drilling front will be steadily enlarged, insuring an increase in the number of oil-bearing areas. This will bring a stream of material, pipe and equipment to places where drilling is to be carried on. Effective measures will be taken to remove obstructions and stoppages occurring in winter."

Portions of German Frontier Contain Valuable Oil Reserves

In German oil circles there is great concern over recommendations of the Six Power Conference in London which contain some suggestions concerning "certain insignificant" adjustmets of the western frontiers of Germany. The Dutch are known to claim a part of the Emsland, which is of considerable importance to German economic life not only because of the textile industry at Nordhorn but because of the oil deposits discovered during the last years of the war.

It was but recently ascertained that according to the most recent drilling results, the narrow strip between the Dutch frontier and the middle Ems near Lingen contains an estimated 65 to 75 million barrels of proven oil reserves. This is thrice the amount hitherto supposed to exist in that area, and it is quite possible that, on the basis of later drilling results, these estimates will have to be further revised. If it is considered that the total Bi-Zone consumption of oil products—gasoline, diesel oil, kerosine, lubricating oil, asphalt, etc.—is now 11 million barrels yearly, the importance of the Emsland becomes quite evident with regard to German supplies of fuel and lubricants. The productivity of the old fields in Hanover and Schleswig-Holstein cannot be compared to the Emsland deposits. Besides, the major part of these oilfields has already been exploited for decades, so that they are slowly being exhausted.

The richest German Emsland field, that of Emlichheim, and the Dutch field of Schoonebeek form one reservoir situated on both sides of the frontier. At this place even the "most insignificant" frontier adjustments would affect Germany's most valuable oil deposits.

The Adorf field, latest of the Emsland fields to go on production, was discovered in 1946, but it is only now that it has been possible to arrange for transportation of the production. At the present time the production of approximately 110 barrels a day is from one well, but two rigs have been moved in to drill additional wells. Production at Adorf comes from a sand body nearly 400 feet thick in the Wealden member of Lower Cretaceous at a depth of 4400 feet, and some difficulty may be encountered in sustained production operations because of the high paraffin content of the crude which runs about 23 percent. The field is operated by the C. Deilmann Company, although the concession is a joint property of the Deilmann, Gewerkschaft Elwerath, Preussag and Wintershall companies.

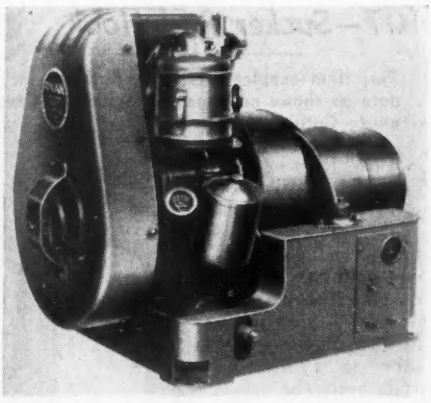
NEW AND IMPROVED Equipment SUPPLEMENTING COMPOSITE CATALOG

New and improved equipment of manufacturers who describe their products or services in the current Composite Catalog

102—Electric Plants

This item supplements D. W. Onan & Sons, Inc.'s data as shown on pages 3256-3257 of Composite Catalog.

The Onan DSP air-cooled diesel engine is the prime-mover for the Onan Model 205DSP, 2500 watt diesel electric plant. Powered by this compact, one-cylinder, four-cycle engine, this power unit makes the economy of full diesel operation available to all users who must supply their own electric power.



Its unusual compactness, (10½ cubic feet) assures maximum adaptability to a wide range of portable or stationary jobs. The application of air-cooling simplifies servicing and reduces maintenance cost.

Electric cranking of the engine is made possible by a specially designed automatic compression release. Conservatively rated at 2500 watts, the plant has an Onan inherently regulated generator which provides good voltage regulation without the use of rheostats or other external equipment. All engine and generator controls required for operation are conveninetly located on the steel base. Rubber shock-mounting eliminates the need of an extra-heavy mounting base.

The plants are available in alternating-current models of 2500 watt capacities, 60-cycle, and voltages of 115 or 230, single-phase, or 115/230-volt, single-phase, three-wire, or 230-volt, three-phase, three-wire.

Standard accessories include two heavy-duty, six-volt starting batteries connected in series, oil filter, oil bath air-cleaner, muffler, two flexible fuel lines, hand crank and an extra fuel injection pump, holder and nozzle. Battery cables, battery hydrometer and remote start-stop station are also included.

For additional information, write D. W. Onan & Sons, Inc., 2739 Royalston Avenue, Minneapolis 5, *referring to* World Oil, *item 102.*

103—Magnetometer

This item supplements Ruska Instrument Corporation's data as shown on page 3725 of Composite Catalog.

The Ruska vertical recording magnetometer is a base station magnetic field balance designed for photographically recording variations of the vertical field intensity at a base station to obtain correction values for field instruments. The design of the instrument permits taking visual readings through a standard magnetometer telescope without disturbing the record which is being taken.

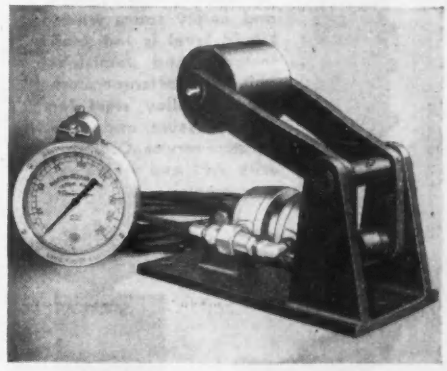
The instrument is fully self-contained and does not require a portable dark room or light-tight tent. The recording magnetometer records time, temperature and diurnal variations in such a way that this information can be readily correlated; nevertheless, the field operator can check in on his base station at any time he selects to do so without disturbing the photographic recording of the instrument. Thus, one operator can do the work for which two operators were previously required.

For additional information, write Ruska Instrument Corporation, 4607 Montrose Blvd., Houston 6, *referring to* World Oil, *item 103.*

104—Torque Gauge

This item supplements Martin-Decker Corporation's data as shown on pages 2505-2536 of Composite Catalog.

The Hydro-Mech Assembly consists of a pressure unit gauge for installation at the driller's position and connecting high-pressure flexible hose. A lever arm carrying a steel idler wheel supported by an "O" ring packed piston and cylinder forms the chain idler assembly.



The chain idler assembly is installed under the tight side of the rotary chain, where by pumping more or less fluid into the cylinder, the idler roller is raised or lowered to deflect the chain (in the same manner that the Martin-Decker Weight Indicator diaphragm deflects the dead line).

The tendency of the chain to straighten under load exerts force against the roller which is supported through the lever by the fluid in the cylinder. Pressure developed within the cylinder varies according to the force exerted on the roller by the deflected chain. Pressure variations are transmitted through the high-pressure hose to the gauge located in the drilling control panel at the driller's position.

The idler roller runs on two tapered, grease packed bearings. Grease is retained by grease retainers which keep grease in and mud and abrasive material out. Grease fitting is provided. The hose is connected to the Hydro-Mech Pressure assembly by means of a Martin-Decker developed self-sealing coupling which automatically seals fluid in the cylinder and hose when disconnected. Therefore, no filling or pumping is required when installed or dismantled.

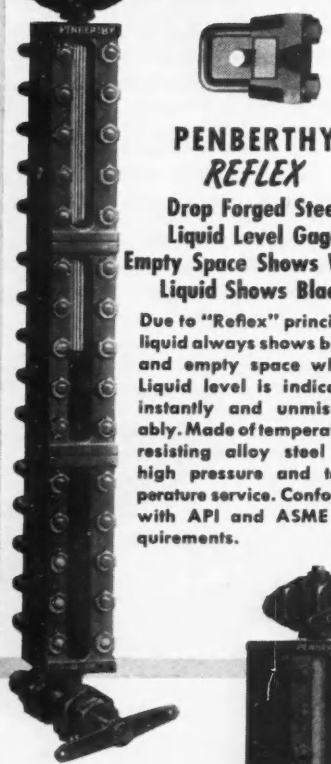
When the idler assembly is to be moved, the self-sealing coupling is disconnected, the hose carried in the panel box.

For additional information, write Martin-Decker Corporation, 3431 Cherry Ave., Long Beach 7, Calif., *referring to* World Oil, *item 104.*

PENBERTHY

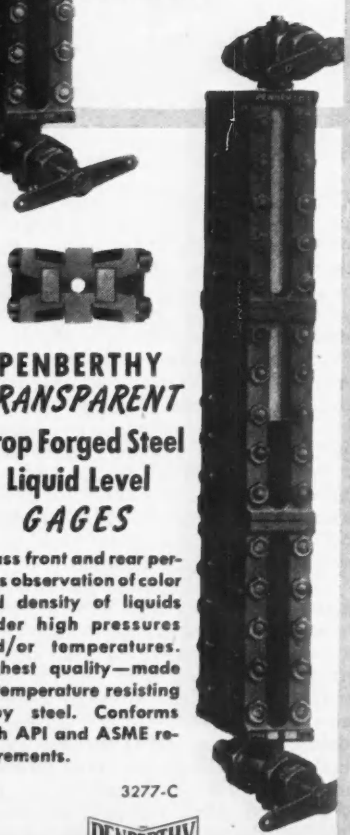
REFLEX and TRANSPARENT

DROP FORGED STEEL LIQUID LEVEL GAGES



PENBERTHY
REFLEX
Drop Forged Steel
Liquid Level Gage
Empty Space Shows White
Liquid Shows Black

Due to "Reflex" principle, liquid always shows black and empty space white. Liquid level is indicated instantly and unmistakably. Made of temperature resisting alloy steel for high pressure and temperature service. Conforms with API and ASME requirements.



PENBERTHY
TRANSPARENT
Drop Forged Steel
Liquid Level
GAGES

Glass front and rear permits observation of color and density of liquids under high pressures and/or temperatures. Highest quality—made of temperature resisting alloy steel. Conforms with API and ASME requirements.

3277-C

PENBERTHY PRODUCTS

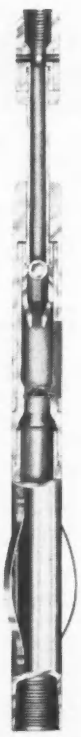
PENBERTHY INJECTOR CO.
Detroit 2, Mich.
Canadian Plant—Windsor, Ontario

NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

105—Hydrostatic Bailer

This item supplements Grant Oil Tool Company's data as shown on pages 1429-1452 of Composite Catalog.



The hydrostatic bailer, Model 6470, utilizes the differential between atmospheric pressure at the surface and the hydrostatic pressure of the fluid column in the well for its powerful action. It picks up movable materials and sucks them into the loading chamber for easy removal at the surface.

The bailer breaks up the hard, tough sand bridges by its positive surging action, and the loosened material is drawn into the loading chamber by the powerful suction. Bridged-over tubing may be cleaned out without the necessity for pulling tubing and killing a flowing well.

The surging action may also be used to uncover large "fish" or sections of drill pipe, tubing gas anchors, or other objects too large to be removed by the hydrostatic bailer alone.

For additional information, write Grant Oil Tool Company, 2042 East Vernon Avenue, Los Angeles 11, Calif., *referring to* WORLD OIL *item* 105.

106—Tubular Derrick

This item supplements Oil Well Supply Company's data as shown on pages 3105-3252 of Composite Catalog.

A derrick of seamless-steel tubing joined together by special flanges, is so designed that the drilling line is located inside the rear derrick legs, enabling the driller to keep sight of the traveling block at all times. This new tubular derrick features the greater operational and safety factors of clear upward visibility and the front legs are reinforced to permit a clear opening of 100 feet on the front side.

The tubular portable derrick is assembled in a horizontal position on the ground. The front derrick legs are hinged to a tubular member located in front of the main derrick base. The crown block and traveling block are strung completely for drilling and the entire derrick is raised as a unit by the drawworks. Raising lines strung over a gin pole are attached to the derrick at a point where the load is balanced. After the derrick is erected, the gin pole can be covered to serve as a roof for the drawworks and engine compound.

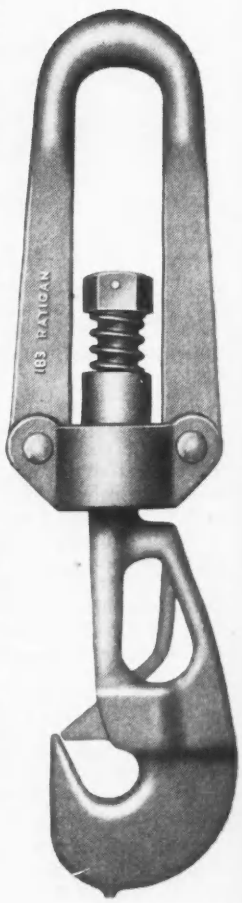
A "screw jack" innovation is set up under the rear supports of the derrick. In the old angle iron derricks, frequently constant work was required to keep the column on an even keel and this was accomplished by manual jacking of the derrick and the thrusting of timbers under the derrick to stabilize its contour. The new system built into the tubular derrick enables the driller, by simple screw control, to raise the rear legs with little effort, permitting adjustment of as much as 27 inches at the crown block.

The derrick can be disassembled quickly and transported in three truck loads.

For additional information, write Oil Well supply Company, Dallas, Texas, *referring to* WORLD OIL *item* 106.

107—Sucker Rod Hook

This item supplements J. P. Ratigan, Inc.'s data as shown on pages 3545-3564 of Composite Catalog.



The Ratigan sucker rod hook will balance the stand of rods in the derrick, so that one man can lift it or pull it down, as desired. Occasionally, when the operator is running rods into the tubing, the stand may not come down the required distance. When this occurs, the man wrenching the rods easily can pull the stand down the required distance. In the event the operator should allow too much slack when he sets back on the elevator, the spring in the hook takes up this slack, holding the stand straight.

The extension of the point beyond the front of the body is another feature which makes it practically impossible for the man "hooking on" to miss placing the bail on the hook.

For further information, write J. P. Ratigan, Inc., 1213 Santa Fe Avenue, Los Angeles 21, *referring to* WORLD OIL *item* 107.

IN 1925 the budget of the Federal Government was 2.7 billion dollars. In the same year Halliburton completed 4,128 cementing jobs at a cost to customers of $1,011,988—an average of $245 per job.

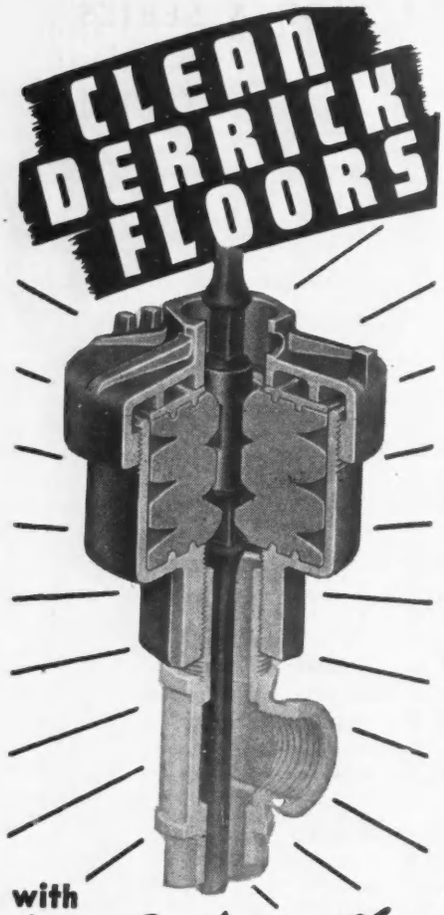
By 1947 the federal budget had increased 1300%. In that year Halliburton completed 67,781 cementing jobs for which its customers paid $13,670,407—an average of $202 per job.

In other words, while the cost of federal services was 13 times *greater*, the cost of Halliburton service was 17% *less*.

Constantly rising prices now force Halliburton to increase cementing prices, but definitely not in proportion to the inflation that we as a nation are now experiencing. Halliburton will continue, as in the past, to provide the most effective and expeditious cementing service that experience, organization and vigilant research can develop—at prices that reflect the economies of highly efficient, large-scale operations.

Erle P. Halliburton

Chairman of the Company
HALLIBURTON OIL WELL CEMENTING CO.
Duncan, Oklahoma



SUCKER ROD STRIPPER

• Type "C" Stripper automatically wipes all oil and paraffin from rods and couplings and keeps gas and oil in the well. Makes cleaner, safer operation for well crew. Adjustable, yet has only four parts, is easily installed, is long-lasting. Available for all size sucker rods to fit all sizes tubing.

Reg. U. S. Pat. Off.

For complete data see Composite Catalog, Page 1537 or write to

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Guiberson U. S. A.

Established 1919

THE GUIBERSON CORPORATION

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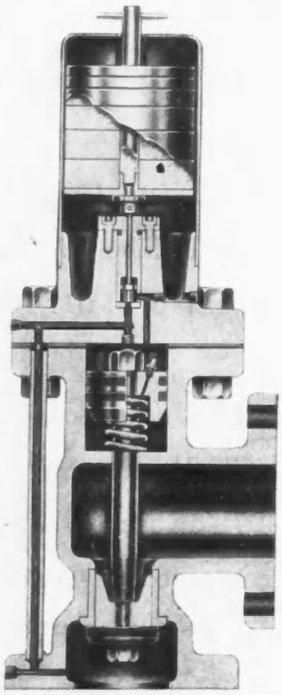
NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

108—Relief Valves

This item supplements the Kinzbach Tool Company, Inc.'s data as shown on pages 2109-2128 of Composite Catalog.



A relief valve for relieving pressure in hydraulic systems containing two moving assemblies, all elements being easily accessible for maintenance and inspection. The valve body and bonnet are of cast steel and the control valve bushing and valve stem are stainless steel especially treated. At normal line pressure the valve is in closed position, the control valve remaining closed because predetermined weights resting on the valve stem offset the thrust from line pressure brought into the control head by channels provided, and simultaneously the valve disc in the lower assembly is held in forced contact with the valve seat effecting a tight seal to prevent by-pass leakage.

When excessive line pressure reaches the control head through the channels provided, it forces the control valve open, lifts the weights at the same time permits fluid to flow into the chamber above the piston which actuates the lower valve disc. The surface area of the piston being greater than the surface area of the valve disc, the piston moves downward, forcing the disc off its seat and providing ample by-pass for fluid passage through the valve. When line pressure is reduced dead weight load will force the control valve into closed position. Fluid trapped in the piston chamber is drained through a small choke valve provided in the piston. A sealing surface is provided on the top side of the control valve stem so that when it seats against a mating surface in the control guide bushing it prevents leakage between this stem and bushing.

For additional information, write Kinzbach Tool Company, Inc., 2418 Winter Street, Houston, *referring to* WORLD OIL, *item 108.*

109—Dual Fuel Attachment

This item supplements the Caterpillar Tractor Company's data as shown on pages 994-995 of Composite Catalog.

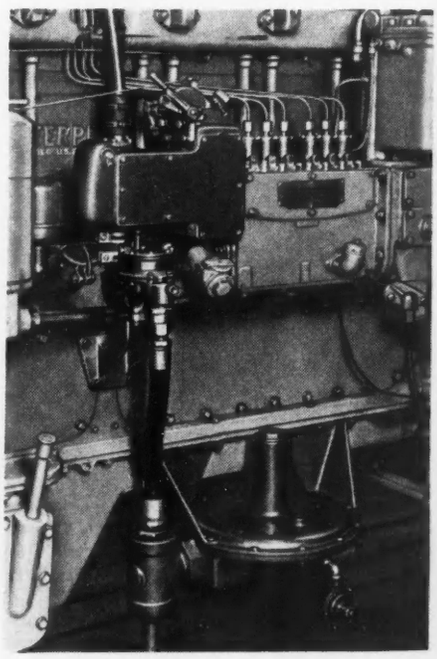
A dual-fuel attachment, designed for service with the "Caterpillar" Diesel D13000 engine, is of particular interest to engine users in, or near, gas-producing areas where pipe line gas usually can be obtained at low cost.

In industrial areas, where "dump gas" rates prevail during the summer months, this low cost gas can be used, changing back to full diesel operation for the balance of the year or for those situations when the engine may be moved to a new site where gas is not available.

The attachment consists of special precombustion chambers, modified fuel injection pumps for precise metering of minute quantities of diesel fuel, a special governor control assembly for interconnected fuel injection pump and gas throttle valve, and the necessary gas lines and pressure regulators.

Once the initial conversion parts have been installed, it is necessary to change only the precombustion chamber in order to convert back to the full diesel engine, a job done without the removal of the cylinder head or any of the dual-fuel attachment.

With the attachment installed, the engine is started on diesel fuel alone and a single manually-operated control lever is used to switch over to natural gas operation with pilot diesel fuel ignition. The governor-controlled gas throttle valve regulates the quantity of natural gas drawn into the engine cylinder and the modified fuel injection pumps meter the diesel fuel, timed for positive ignition of the high temperature, high pressure air-gas mixture.



For additional information, write Caterpillar Tractor Company, Peoria 8, Ill., *referring to* WORLD OIL, *item 109.*

For the Latest in Controls

IT'S FRANKS TELEMECH

MAIN FEATURES

- Avoids "blind spots" in any derrick.
- Complete air operation from remote position of both high and low drum clutches, giving gradual feather-like engagement and electrically controlled snap-back disengagement at the will of the operator.
- Remote air operation of drum brakes giving desired amount of brake tension.
- Master engine clutch, a safety feature.
- Air controlled accelerator from remote position, giving complete range of engine speeds.
- Easily read tachometer, and two air pressure gauges, one showing reservoir pressure and one showing brake diaphragm pressure.
- Electric starting button for remote starting of power plant.
- Ignition key and lock on control panel.

Franks TELEMECH is a master control panel or box designed for the modern servicing unit and drilling rig. It permits finger-tip touch control with a full range of adjustment and speed of the winch unit, power plant, clutch and brakes at the best operating position relation to the well head. It has been tested over several years by a ma company and proven thoroughly satisf

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Mount Vernon, Illinois: Vern Alley, Box 33, Phone 1543-JX
Compton, California: George Lewis, 909 North Alameda St., Phone Newmark 2-4181
Alice, Texas: A. J. "Red" Rogers, Box 31, Phone 1757

FRANKS MFG. CORP.
WELL SERVICING AND DRILLING UNITS
TULSA, OKLAHOMA

FRANKS MANUFACTURING CORP.
Box 3218 **Tulsa, Oklahoma**

NEW EQUIPMENT

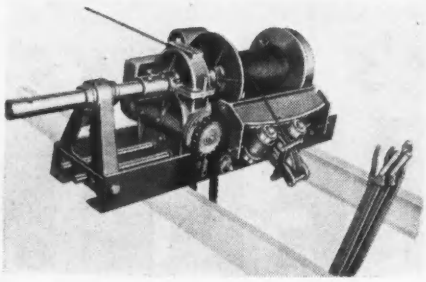
SUPPLEMENTING COMPOSITE CATALOG

110—Truck Winch

This item supplements Gar Wood Industries, Inc.'s data as shown on page 778 of Composite Catalog.

Costly, dangerous cable damage or breakage from loose and crossed coils are said to be eliminated by an automatic spooling and tensioning device in the Gar Wood Reel-Rite truck winch.

The spooling and tensioning device spools smoothly and tightly and the tensioning sheaves apply proper tension even when the cable is slack. As a result, the cable is laid on in smooth, even, closely coiled layers. There is no bunching or piling up of coils, no crushing of rope, no cutting and breaking of strands due to uneven winding. The spooling unit is not mechanically linked to the winch drive so it automatically compensates for any change in rope diameter, stretch speed or wear.



In addition to the level winding feature, this winch has all the features of other Gar Wood Winches: detachable back draft clutch, heat treated alloy steel shafts, ball bearing mounted worm, automatic safety brake, and patented flexible suspension.

For additional information, write Gar Wood Industries, Inc., Michigan Boulevard, Wayne, Mich., *referring to* WORLD OIL *item* 110.

111—Consolidated Rig

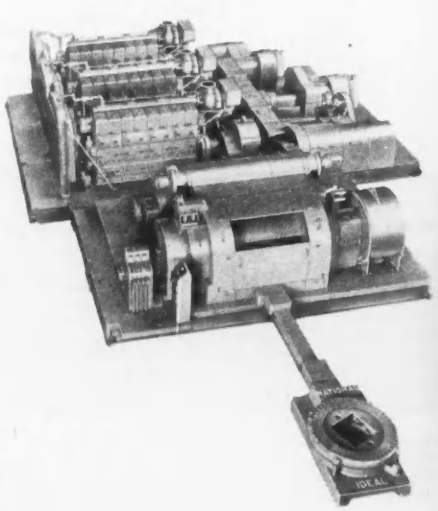
This item supplements The National Supply Company's data as shown on pages 2793-2892 of Composite Catalog.

The Ideal type 160 consolidated rig is a modern development in heavy-duty rotary machinery, designed and built to meet the rigid requirements of deep well drilling. Type 160 rig is engineered to handle maximum casing load with simplified operation, efficiently drilling deep wells with more speed. Three PTDS-8 supercharged diesel engines develop over 2000 horsepower for drilling and hoisting operations.

The three engines are arranged in a sectional drive group incorporating Ideal-Gyrol Fluid Drives, providing six hoisting speeds, six rotary speeds, and three catshaft speeds. A two-speed pump drive gives pump flexibility.

The drawworks is designed to use 1½ inch wire line. The large drum permits hoisting 135-foot drill pipe stands with 8 lines without spooling more than three full layers of line on the drum, with resulting lower operating cost.

For additional information, write The National Supply Company, Box 899, Toledo 1, Ohio, *referring to* WORLD OIL, *item* 111.



FOR THE BEST IN CABLE TOOLS

Fig. F460 Fig. F467

SPANG
CENTER ROPE SPEAR
(Fig. F460)
THREE-PRONG GRAB
(Fig. F467)

For fishing broken cable and sand line, Spang furnishes a variety of Center and Side Rope Spears, as well as Two- and Three-Prong Grabs.

Strands of cable left attached to the rope socket may be removed with the Spang Drill Mill, or the Spang Drive Down Socket or Trimmer.

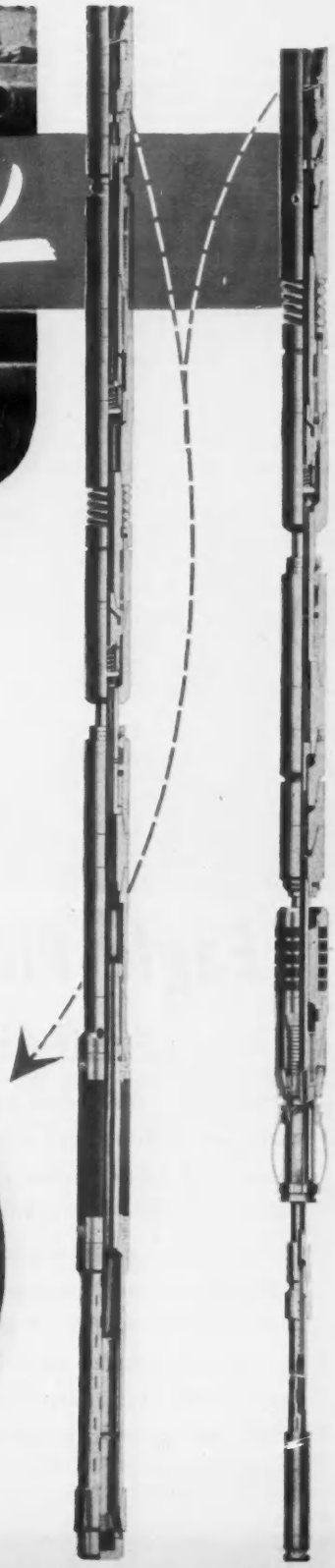
For the best in Cable Tools,
SPECIFY SPANG

THE HIGHER STANDARD

SPANG & CO.
BUTLER, PA.

YOUR DEALER SELLS SPANG TOOLS

DON'T RUN IT BEFORE YOU *Know*

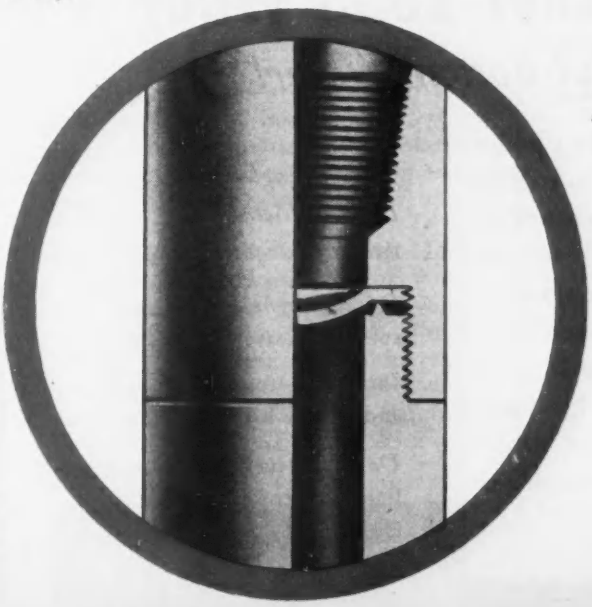


With pipe as scarce as it is today, it's more important than ever that you "call Johnston" and test your formations *before* you set that hard-to-replace casing. After a Johnston test, you're no longer gambling . . . you *know* the potential of your well. Johnston tests obtain actual samples of formation fluid, with recorded charts of bottom hole flowing and shut-in pressures and from these the productivity index of any well can be easily determined.

***After* casing is set, Johnston Testers can determine the effectiveness of cementing and perforating jobs or make production tests that duplicate actual flowing conditions. A double-packer tool is available for use in dual completion wells, so that either zone can be tested independently of the other.**

To remove a big gamble from your operations, "Call Johnston" for an authentic, economical preview performance of your producing zones. There's an experienced Johnston representative near, ready to serve you twenty-four hours a day.

AN *Exclusive* JOHNSTON Feature that Assures Authentic Results



This disc valve in Johnston Open Hole and Casing Testers prevents drilling fluid from contaminating formation fluid and further differentiates between formation fluid and that entering through leaks in the drill pipe. It's an *exclusive* Johnston feature that guarantees authenticity of formation tests.

JOHNSTON OIL FIELD SERVICE CORPORATION
5702 Navigation Blvd., Houston, Texas
"SERVICING MID-CONTINENT AND GULF COAST AREAS"
Cisco, Alice, Tyler, Victoria, Wichita Falls, Graham, Throckmorton, Texas; Lake Charles, Shreveport, Louisiana; Magnolia, Arkansas; Laurel, Natchez, Mississippi; Chickasha, Oklahoma; New Harmony, Indiana; Fairfield, Illinois.

M. O. JOHNSTON OIL FIELD SERVICE CORPORATION
3035 Andrita Street, Los Angeles 41, California
"SERVICING CALIFORNIA—PERMIAN BASIN—ROCKY MOUNTAIN AREAS"
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M. O. JOHNSTON OIL FIELD SERVICE COMPANY
"EXCLUSIVE EXPORT SALES"
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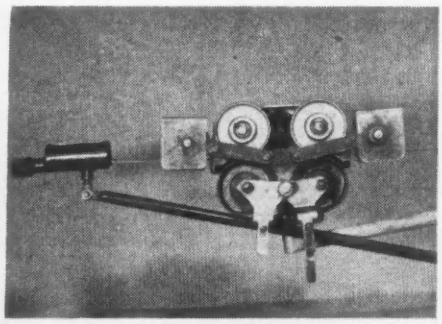
FORMATION AND CASING TESTING
JOHNSTON

OTHER NEW AND IMPROVED *Equipment*

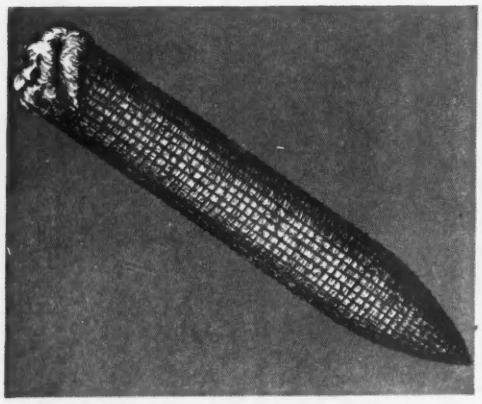
112—Wire Line Wiper



An automatic wire line wiper designed to prevent corrosion of steel well measuring lines is known at the A-J line wiper. The instrument is designed to clean and oil steel measuring lines in one operation. The device can be used on all sizes of line and is easily adapted to all types of measure meter equipment.

It consists of a small cylinder which is kept filled with oil and waste. A packing gland nut in which are a number of rubber washers is welded on one end of the cylinder, which is equipped with a measure meter connecting device. The cleaning is done by a packing gland arrangement followed by an oil bath and the design eliminates messy splashing of fluid. Cleaning and oiling of steel measuring lines, which is ordinarily done manually, will result in better performance of the metering device and prolongs the life of the line.

For additional information, write McNaughton Tool and Instrument Company, 1333 East 6th Street, Tulsa, *referring to* WORLD OIL, *item 112.*



Don't risk Bottom Water shutdowns

Eagle-Picher Lead Wool

shuts out Bottom Water!

Prevent costly shutdowns, keep bottom water out of your wells with effective, economical Eagle-Picher Lead Wool. The fine, durable strands fill cracks and crevices with a permanent, non-corrosive seal...save you time and money. Packed in convenient 50-pound sacks — easy to place in special cartridge-shaped Eagle-Picher Wire Containers sized to fit all casings. Order through your jobber today!

These 3 Eagle-Picher Bearing Metals meet most requirements

Dreadnaught — for extreme speed and heavy-duty conditions.

Outlasta — for medium speed and average-load conditions.

Durable—for low speed and light-duty conditions.

EAGLE-PICHER LEAD WOOL

Seals off Bottom Water— keeps 'em flowing!

THE EAGLE-PICHER COMPANY

EAGLE Since EP 1843 PICHER

Cincinnati • East St. Louis
Chicago • Kansas City • Dallas

113—Blowdown Assembly

The advent of really high pressure gas lines indicated the advisability of a departure from the conventional multi-toggle bolt type flange cover and the widely used, blind flange cover.

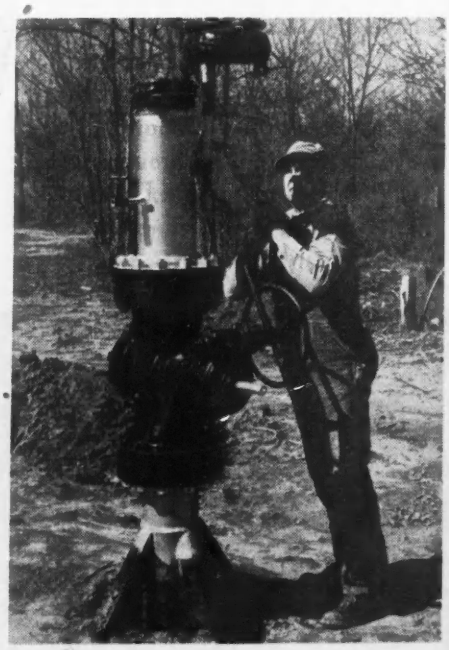
A gas pipe line appurtenance was designed to eliminate the task of removing the large number of bolts used on those devices.

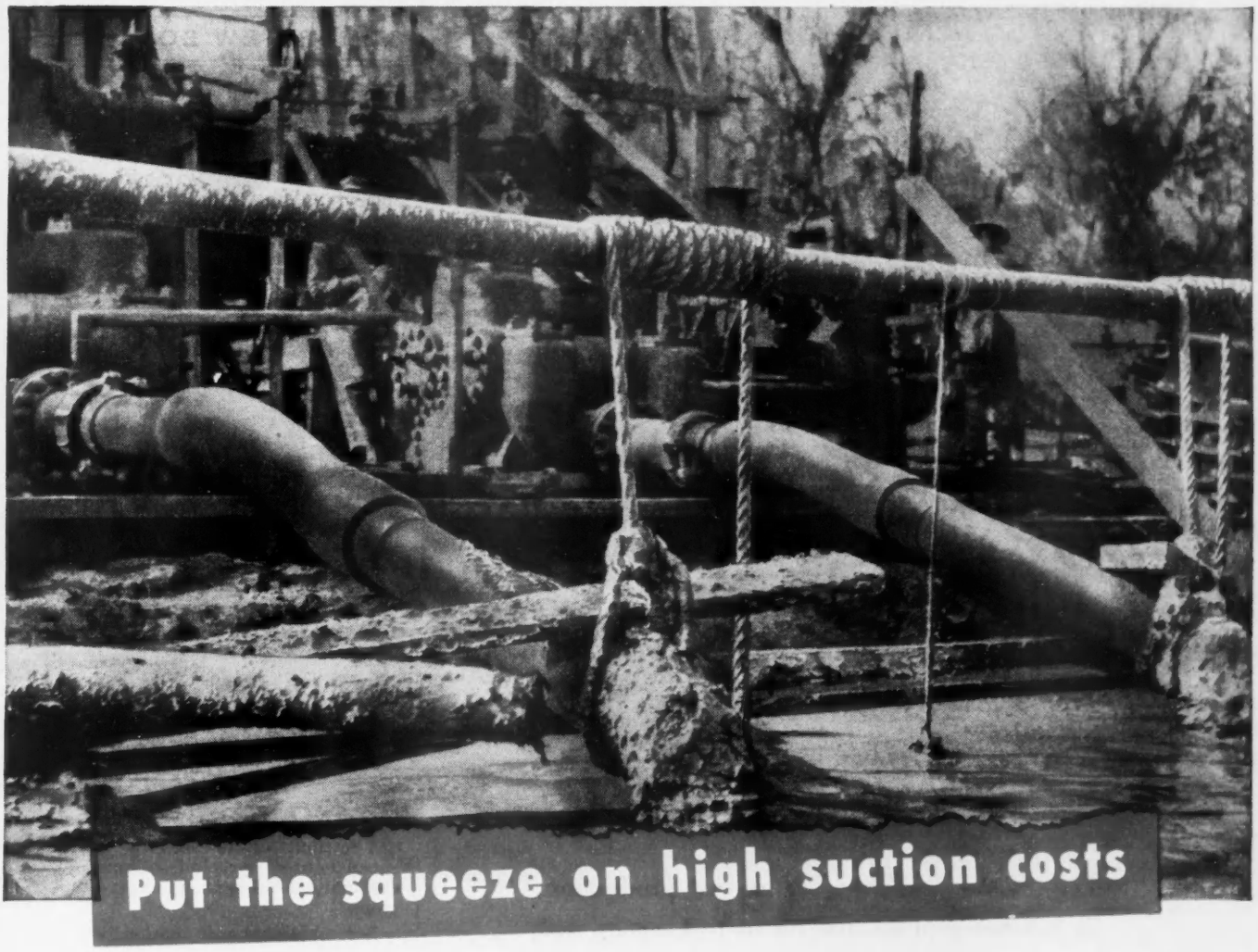
A conventional two bolt, bayonet type closure cover is combined with refinements which minimize physical effort in its operation. The assembly permits placement of the high frequency noise zone of the blowdown tube well above ear level and still affords ready access to the operating components from ground level.

These features eliminate climbing or other forms of unsafe practices generally required to operate the currently used types of purging devices.

The assembly is available in pipe sizes, four to 12 inches, for most A.S.A. pressure rating. It is furnished with flanged end for valve mounting or welding end for replacement of existing purging assemblies.

For additional information, write Superior Iron Works & Supply Company, Inc., Shreveport, La., *referring to* WORLD OIL, *item 113.*





Use Hewitt Mud Pump Suction Hose

Just one try is all it takes to discover the profit protection advantages of Hewitt Mud Pump Suction Hose.

Try it and you'll join wide-awake drilling contractors in applauding the way this hose helps you put the squeeze on high suction costs.

When you use Hewitt Mud Pump Suction Hose you avoid hose replacement, kinking and collapse under suction. That's because the tough carcass is reinforced by spiraled spring steel wiring.

You avoid *all* possibility of the tube pulling loose under suction. Hewitt adds a ply of breaker fabric to strengthen the bond between inner tube and carcass. Built-in clampless nipples are permanently sealed and anchored in the hose.

All these features are protected for you by a tough, heavy cover. It's especially compounded to withstand severe abrasion, rough handling and extreme weather conditions.

Find out today how Hewitt Mud Pump Suction Hose can cut your high suction costs . . . boost your production efficiency. Call your Hewitt distributor listed in the classified section of the telephone directory. Or write to Hewitt Rubber Division, 240 Kensington Avenue, Buffalo 5, New York.

HEWITT

Mud Pump Suction Hose

YOU CAN'T BUY A BETTER HOSE FOR MUD SUCTION PUMPS!

❶

Tube adhesion! The inner tube of the Hewitt Mud Pump Suction Hose is inseparably bonded to duck carcass, preventing collapse under suction.

❷

Abrasion resistant! Its smooth, specially compounded inner tube easily resists the severe scouring action of drilling muds.

❸

Long Life! Its duck and spiraled round wire carcass results in maximum flexibility yet resists kinking or collapse, assuring long life of hose.

HEWITT RUBBER DIVISION **HEWITT-ROBINS INCORPORATED**

More... and more... Briggs & Stratton Engines every day

For several years, despite record production, it has been impossible for us to keep up with the rapidly increasing demand for more and more Briggs & Stratton gasoline engines. Now, however, more equipment and appliances than ever before are being powered with Briggs & Stratton engines.

Many models are now available for replacement or auxiliary power. See them on display at your nearest Briggs & Stratton Authorized Service Station or dealer.

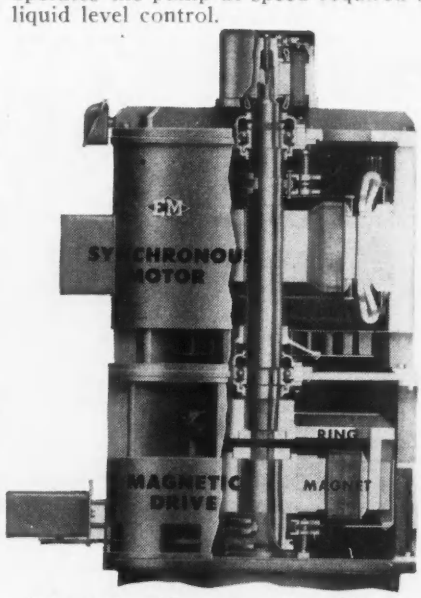
BRIGGS & STRATTON CORPORATION
Milwaukee 1, Wis., U. S. A.

4 CYCLE
BRIGGS & STRATTON
GASOLINE ENGINES
Preferred Power
FOR INDUSTRIAL CONSTRUCTION RAILROAD AND FARM EQUIPMENT

OTHER NEW EQUIPMENT

114—Vertical Drive Unit

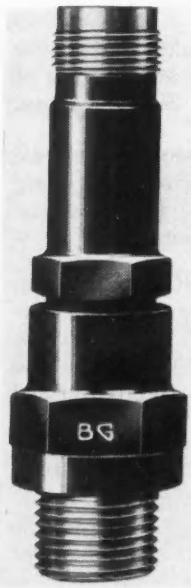
The vertical synchronous motor magnetic drive unit gives smooth adjustable speed control for centrifugal pumps. The motor drives the ring of the magnetic drive at constant speed. Magnet member of magnetic drive mounted on gear shaft operates the pump at speed required by liquid level control.



The unit offers smooth, wide-range speed control, precludes "hunting," and eliminates frequent motor starts and stops.

For additional information, write Electric Machinery Manufacturing Company, Minneapolis 13, *referring to* WORLD OIL *item* 114.

115—Shielded Spark Plug



A shielded spark plug, especially applicable for the petroleum industry, is designed to give trouble-free service with a minimum of maintenance for long periods. Life of the spark plug is greatly increased by the use of platinum electrodes as well as by embodying a resistor within the upper part of the ceramic core. This resistor decreases the flow of current through the gap after the spark has occurred and thus reduces electrode erosion.

The material in the insulator is specially designed so that its heat transfer properties meet the requirements of internal combustion engines and its electrical and chemical qualities adapt it especially to continued operation at high temperatures.

For additional information, write BG Corporation, 136 W. 52nd, New York, N. Y., *referring to* WORLD OIL, *item* 115.

Aerial Mapping Shows Us...

Now petroleum management, its engineers and exploration geologists can meet—far from the scene of operations—to decide upon exploration programs and detailed development plans. For Aero Service Corporation brings reliable planning facts to the conference room . . . facts in the form of aerial photo mosaics . . . topographic maps . . . planimetric maps. More —our Airborne Magnetometer Surveys swiftly collect precise magnetic data regarding subsurface structures.

AERO has completed many thousands of square miles of mapping for companies studying the geology of particular areas, and planning refineries, pipe lines, roads, communications and other phases of oil field development. *Time has a big price tag in exploration work*—AERO maps and mosaics make possible important savings in both time and man-power. AERO's Magnetometer Surveys provide reliable data for your geologists through rapid reconnaissance of large areas.

AERO's facilities and experienced personnel are ready to do your aerial mapping anywhere in the world. We are accustomed to meeting management's requirements of swift scheduling and strict confidence. We will be glad to meet with you for consultation.

Write for our recently published book, "You Can See More From The Air."

★

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SERVICE CORPORATION
VIRGIL KAUFFMAN, President

236 E. COURTLAND ST., PHILADELPHIA 20, PA.

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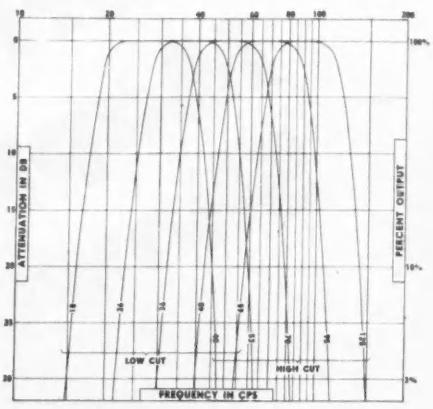
116—Seismic Filter

An advanced electronic filter for use in seismic exploration equipment, Type K-2, is available for installation in existing or new designs. The filter comes in two units, a high cut and a low cut. For operational purposes, high and low cut positions may be selected independently and five of each are nominally available.

The filter is of the passive insertion type, there being no vacuum tubes, power consumption, non-linear devices, or null circuits involved. In use, there is nothing in the way of close balances or critical adjustments to be disturbed nor spurious oscillations to appear.

The components used are held to a one percent tolerance so that reproduction from one filter to the next is very close. Voltage stability of the inductances employed is held within 15 for the voltage variation of 0.1 to 1.0 volts. This enables the filter to possess adequate voltage stability for use in those parts of the system where the energy range is uncompressed. This makes the application of the filter universal as to position in the system.

The transmission characteristics of the low and high cut units are identical except for the inverse frequency axis of the one. Each of the units contains two sections, one of which may be switched out should less filtering be desired.



The attenuation beyond the pass band as shown on the curves, in general, increases as the distance from cut-offs is increased and in no event is less than the maximum value on the illustration. The increase is not monotonic, however, due to the actual points of infinite attenuation in the attenuating regions. At these points, the attenuation is infinite and very high in their vicinity. One of the principle features of this filter is the attainment in practice of infinite attenuation at desired points other than at the zero or infinite frequency extremes.

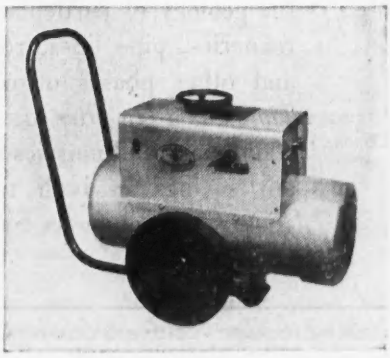
For additional information, write Geotronic Laboratories, The Garrett Exploration Company, 5331 Yale Street, Dallas, *referring to* WORLD OIL, *item 116.*

117—Arc Welding Machine

The "Hornet" 36A motor generator arc welding machine is a heavy duty machine with simple control of current that is easy to adjust and preset accurately. It is smaller in size and weighs one-third less than the previous "Hornet" models. This machine is designed for either 220 or 440 volts with no change in relays or additional wires being required for voltage reconnection.

The heavy duty "Hornet" 36A is designed to furnish a smooth steady current for every industrial welding job under the most adverse conditions, because of its weather resistant totally enclosed drip proof construction and special moisture proof insulation.

For additional information, write Wilson Welder and Metals Company, Inc., Dept. 1609P, 60 East 42nd Street, New York 17, *referring to* WORLD OIL, *item 117.*



Service Proves Value!

Be Sure IT'S A KING *Be Safe*

KING SWIVELS 53-GA, 32-GA AND 20-GW

THE PRINCIPAL USES OF THESE SWIVELS ARE:

1. **Drilling shallow and medium depth oil wells.**
2. **Drilling water wells.**
3. **Core Drilling and Geophysical Drilling.**
4. **For slim hole drilling.**
5. **Working over oil wells.**
6. **Washing down pipe and tubing.**
7. **Running with inside pipe cutting tools.**
8. **Running with fishing tools.**
9. **As all purpose, lightweight swivels.**

Types 32-GA, 53-GA and 20-GW swivels are alike in general design, but vary somewhat in detail.

These swivels have been field proven by several years of service and have been accepted as leaders in their class. They are in service throughout most of the oil world.

There are no other swivels which are comparable on a basis of capacity in proportion to weight.

Their high capacity in relation to their lightness makes them ideal for use in remote and inaccessible places.

The 53-GA is used for drilling medium depth oil wells; also used extensively on work-over rigs. It is an ideal swivel for slim hole drilling.

The 32-GA is used with large water well rigs and for drilling relatively shallow oil wells. It is also used with long strings of tubing for washing down and similar operations.

The 20-GW swivel is used for drilling shallow and medium depth wells. The 20-GW is the smaller of the three and is used on water wells, core drilling rigs and the heavier types of Geophysical Rigs. It is also suitable for handling tubing in the shallower oil fields.

All materials used in King Swivels are the best and most suitable for their purpose. Lubrication is provided and all connections are to API specifications or to the order of the customer.

See 1948 Composite Catalog (Pages 2129 to 2140) for other King Tools.

Order Through Your Supply Store

EXPORT: R. S. STOKVIS & SONS, INC.
17 Battery Place, New York 4, N. Y.

KING OIL TOOLS

210 TERMINAL STREET PHONE W. 6-8013

HOUSTON 10, TEXAS

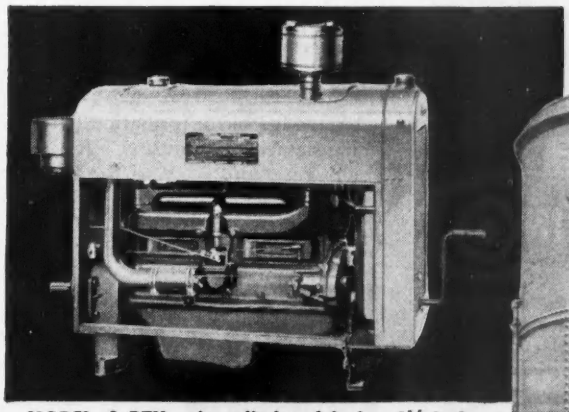
COMPRESSOR PLANTS GET *more power...* USE *less fuel* ...WITH waukeshas

● The CONTROLLED TURBULENCE Combustion Chamber *and* the specially designed intake manifold are but two features of the Waukesha 6-BZU power unit's most-modern-design features.

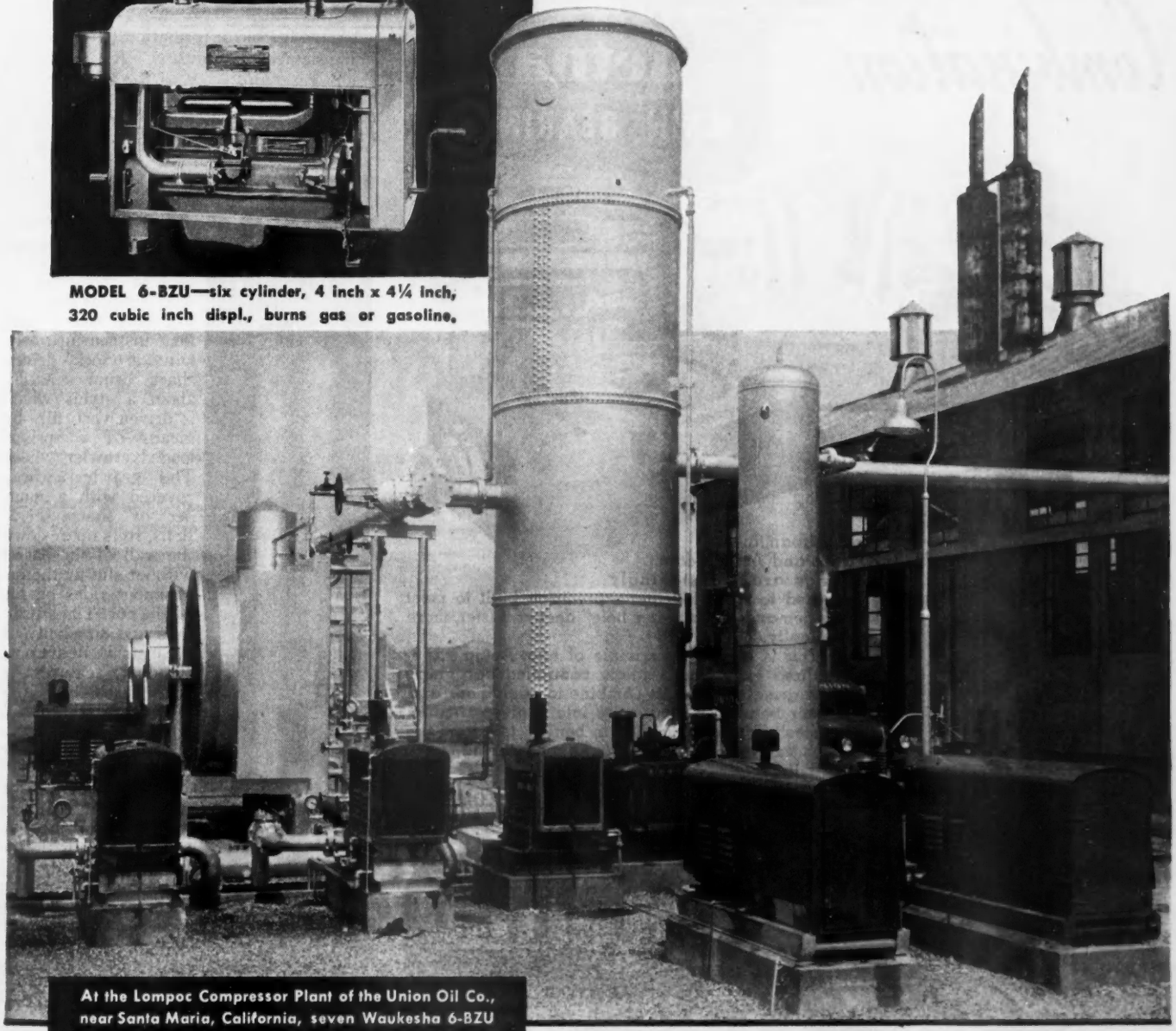
With this combination more usable power is built into this Waukesha unit, in such a way that it can put out that extra power with increased fuel economy.

Specially shaped to increase turbulence, the Controlled Turbulence Combustion Chamber speeds up combustion in an orderly progressive manner which reduces "ping," and insures the complete burning of the charge before the exhaust valve opens. This means less fuel, yet more power.

And the fuel charge is balanced. That means it is evenly distributed between the cylinders. The power delivered is *smooth* power. Heating of the incoming fuel-air mixture varies, as the load requirements vary. That makes the engine respond instantly to power demands. Bulletin 1269 tells you all about rugged construction and longer wearing working parts.



MODEL 6-BZU—six cylinder, 4 inch x 4¼ inch, 320 cubic inch displ., burns gas or gasoline.



At the Lompoc Compressor Plant of the Union Oil Co., near Santa Maria, California, seven Waukesha 6-BZU power units drive radiator fans, Byron-Jackson pumps, air compressor, and electric generators.

WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN

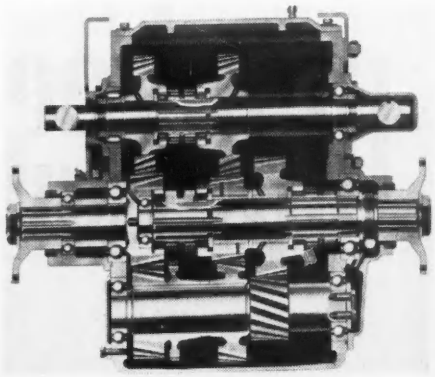
NEW YORK ● TULSA ● LOS ANGELES

118—Auxiliary Transmission

A three-speed auxiliary transmission providing a full-torque power takeoff in the transmission case is Fuller Manufacturing Company's Model 3-T-92. It offers in a single unit all of the advantages normally provided by the use of auxiliary transmissions with top-mounted power takeoff, and at the same time eliminates the inherent weaknesses of this combination. For rigidity and strength the power takeoff gears and shaft are built directly into the transmission case where the section of the casting will permit the application of full engine torque.

The ratios available from the full torque power takeoff vary with the direction of rotation of the shaft. When turning in the same direction as the input shaft of the auxiliary transmission, the ratio is 1.75 to 1. When rotation is in the opposite direction, the ratio is 1.345 to 1. The power takeoff shaft has been set up so that power may be taken from projections at either the front or rear ends which are machined and keywayed to permit the use of flanges, sprockets, etc. bored to an inside diameter of 1¾ inches and keywayed for a 3/16 x 3/8-inch straight key.

For flexibility of operation, the full torque power takeoff will provide both forward and reverse speeds. The range of speeds will depend directly upon the number of forward speeds available from the unit type transmission attached directly to the engine.



For motive power, Model 3-T-92 provides the same transmission gear ratios offered in Model 3-A-92 Fuller auxiliary transmission.

For additional information, write Fuller Manufacturing Company, Kalamazoo, Mich., *referring to* WORLD OIL *item* 118.

Winning Combination

IDECO ROTARIES + Aetna MAIN BEARINGS

Contributing factor to the trouble-free, continuous operating ability of this Ideco Rotary is the high thrust capacity and low friction coefficiency of its angular contact main bearing . . . by AETNA.

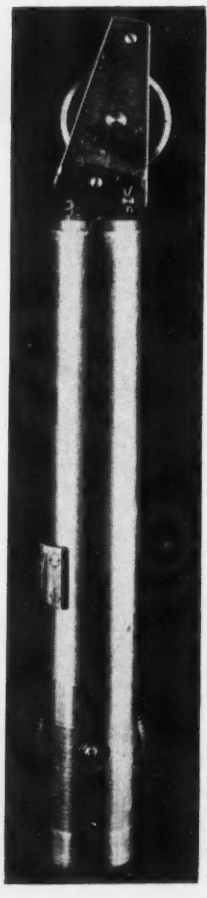
Ideco streamlined Rotaries and Aetna Main Bearings are painstakingly engineered to work together—precision built to meet today's demand for "making hole" deeper, faster, more economically.

This is a typical example of how Aetna's specialized experience, rigidly controlled hardening and grinding methods combine to pack more and better bearing performance into a given amount of steel. Your equipment can benefit, too, from the plus value built into every Aetna bearing. Let's talk it over?

AETNA BALL AND ROLLER BEARING COMPANY
4600 Schubert Ave., Chicago 39, Illinois

Aetna
BALL AND ROLLER BEARINGS

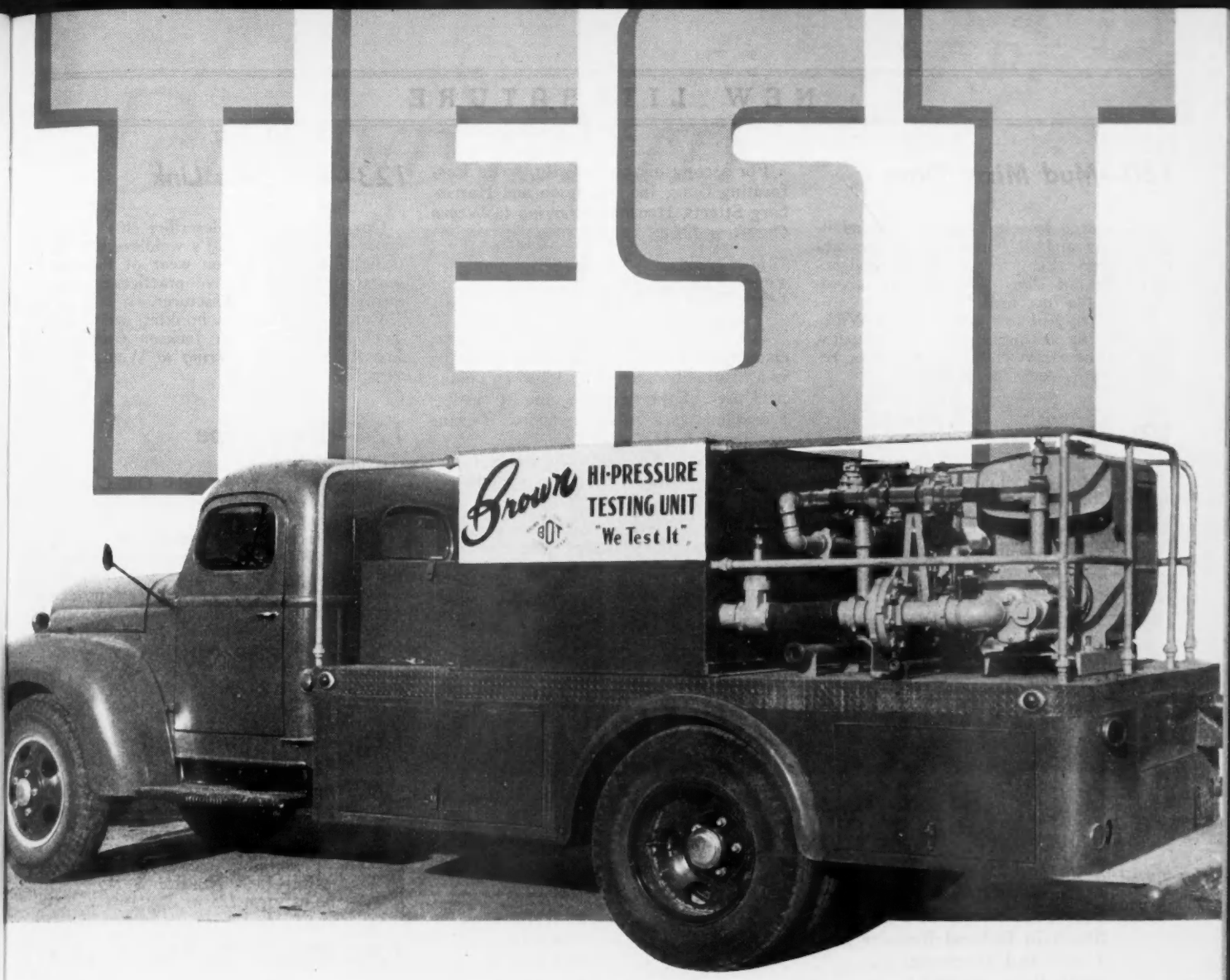
119—Core Recorder



The core recorder is an instrument designed to determine graphically the exact depths from which a core is recovered or lost. It is placed in the core barrel and the instrument contains a clock-driven chart drum rotating about a stylus which is driven vertically by means of a spring-loaded crawler wheel. The crawler wheel, covered with a number of sharp serrations, rolls up or down the wall of the barrel without slip as the instrument rides on top of the cor. The sturdiness and simplicity of the instrument are outstanding features as there are only four moving parts, exclusive of the shock-proof, non-magnetic clock.

A record of drilling time and depth is kept at the top of the hole to correlate with the record from the instrument so that an accurate determination can be made of the depths of any movement or lack of movement caused by core entering or leaving the barrel or by being drilled up.

For additional information, write Core Recorder, Inc., 817 Thompson Building, Tulsa, *referring to* WORLD OIL, *item* 119.



AND BE SURE OF YOUR PIPE AND PRESSURE VESSELS

Don't take chances. There is too much at stake to risk using pipe and pressure vessels unless you know by actual test they will hold the pressure at which they are to be used. On the spot testing is economical, efficient, quick, with the BROWN HI-PRESSURE TESTING UNIT. This truck mounted unit can be brought to your location on short notice and immediately test your equipment for fitness of service.

The Brown-Hi-Pressure Testing Unit is capable of developing 20,000 pounds pressure. A special control device enables the operator to pre-set the pressure at which the pipe or vessels are to be tested. The Unit cannot develop more than this pre-set pressure, thereby eliminating danger of applying excessive pressure to the equipment.

The Unit is so designed that it fills, tests and drains the equipment being tested. The water or other hydraulic medium being used is forced back into the tanks instead of being dumped onto the testing site.

Pipe can be tested on a truck, in the yard, on derrick racks or standing in the derrick. Rapid-change testing plugs eliminate danger of galling pipe threads.

BE SURE your pipe and pressure vessels are safe. Have them hydrostatically tested with the BROWN HI-PRESSURE TESTING UNIT.

On-location-testing is

ECONOMICAL
EFFICIENT
QUICK

Brown OIL TOOLS, INC.

HOUSTON, TEXAS

EXPORT SALES: Acme Well Supply Co., 19 Rector Street, New York 6, N. Y.

120—Mud Mixer Data

A six-page looseleaf folder contains illustrations and diagrams of the Wichita mud mixer. Features of design and installation are shown, as well as advantages of the mixer.

For a copy of this folder, write Wichita Welding & Manufacturing Company, P. O. Box 64, Wichita Falls, Texas, *referring to* WORLD OIL, *item 120.*

121—Jet Gun

A bulletin describing the jet shot has recently been released.

For a copy of this bulletin, write Perforating Guns, Inc., Sampson and Harrisburg Streets, Houston, *referring to* WORLD OIL, *item 121.*

122—Hystaway

The Hystaway — combination dragline, clamshell crane, and bulldozer—is described in a 12-page booklet which illustrates many field uses of the versatile unit. Its use as a dragline, as a bulldozer, and as a crane or clamshell are shown.

For a copy of this booklet, write Hyster Company, Peoria, Ill., *referring to* WORLD OIL, *item 122.*

123—Weedless Link

One-page mailer describes the short upper eye design of BJ's weldless link. It includes information on wear of the link seats and the corrective practices recommended by the manufacturer.

For a copy of this booklet, write Oil Tool Division, Byron Jackson Company, Los Angeles 54, *referring to* WORLD OIL, *item 123.*

124—Weld Pipe

"Republic Electric Weld Oil Country Goods" is the title of an eight-page, two-color booklet which gives the highlights of the manufacture of Republic electric resistance weld pipe as the process affects the quality of the product. It points out the advantages of the electric weld process for oil country line pipe, casing and tubing.

For a copy of this booklet, write Republic Steel Corporation, Advertising Division, 3100 East 45th Street, Cleveland 4, *referring to* WORLD OIL, *item 124.*

125—Gas Equipment

An eight-page booklet describing HOMCO gas equipment in full detail is now available.

For a copy of this booklet, write Houston Oil Field Material Company, Inc., P. O. Drawer 2589, Houston 1, *referring to* WORLD OIL, *item 125.*

126—Diesel Drilling Engine

Superior PTD diesel drilling engines, including engines with dual fuel equipment, are described and illustrated in a 20-page bulletin, No. 318-A.

For a copy of this bulletin, write The National Supply Company, Box 899A, Toledo, Ohio, *referring to* WORLD OIL, *item 126.*

127—Safety Walk

Non-slip "Safety-Walk" surfacing for ramps, catwalks and areas such as the floor around the rotary table of an oil well drilling rig, is pictured in a four-page brochure.

For a copy of this brochure, write Minnesota Mining and Manufacturing Company, 900 Fauquier Avenue, St. Paul 6, Minn., *referring to* WORLD OIL, *item 127.*

128—Valve Bulletin

An eight-page American Car & Foundry Company bulletin illustrates the ACF full pipe area, lubricated plug valves in steel, semi-steel, and other metals for acids, caustics, chemicals, oil, water and other fluids. Flow principle of the full pipe-area valve are depicted.

For a copy of this bulletin, write American Car & Foundry Company, Valve Department, 30 Church Street, New York, *referring to* WORLD OIL, *item 128.*

REPUBLIC NATIONAL BANK
of DALLAS

Statement of Condition June 30, 1948

RESOURCES

Cash and Due From Banks		$ 99,293,069.93
U. S. Government Securities		60,346,618.34
State, Municipal and Other Securities		835,578.31
Stock in Federal Reserve Bank		750,000.00
Loans and Discounts		141,428,005.00
Bank Premises and Equipment		2,807,657.42
Customers Liability — Acceptances and Letters of Credit		733,848.79
Total		$306,194,777.79

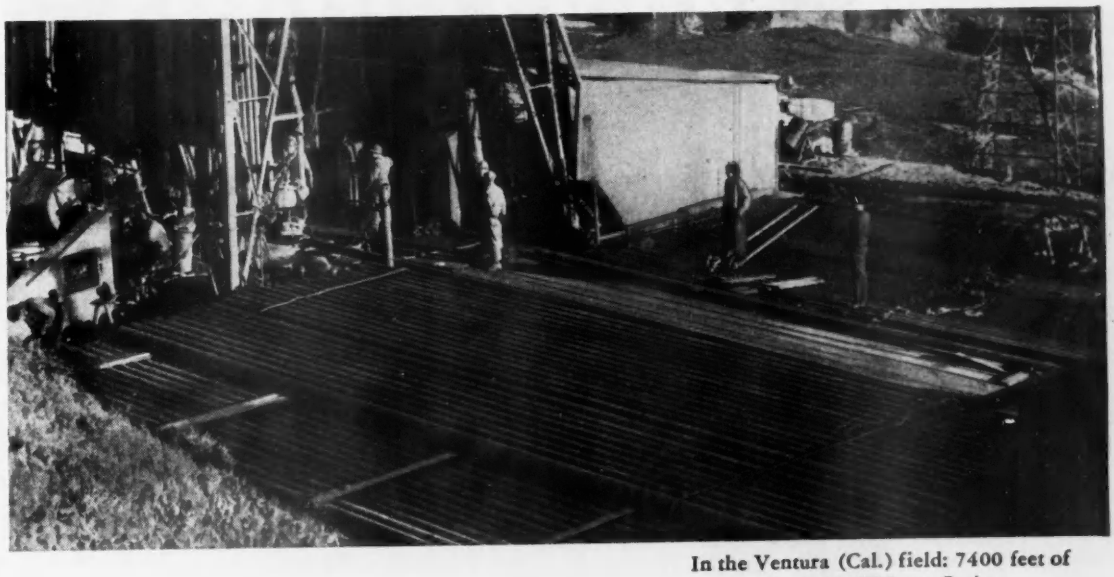
LIABILITIES

Capital	$ 12,000,000.00	
Surplus	13,000,000.00	25,000,000.00
Undivided Profits		1,816,925.33
Reserve for Dividend, Payable July 1, 1948		240,000.00
Reserve — Under Authority U. S. Treasury, Mim. 6209		1,774,584.87
Reserve for Taxes, Etc.		1,090,691.37
Acceptances and Letters of Credit		733,848.79
Deposits:		
Individual	$192,639,283.63	
Banks	80,984,930.08	
U. S. Government	1,914,513.72	275,538,727.43
Total		$306,194,777.79

A LEADER in providing
STRONG CAPITAL
UNEXCELLED FACILITIES
PERSONAL SERVICE

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

DEPENDABILITY



In the Ventura (Cal.) field: 7400 feet of 7-inch SMITHway Casing.

THROUGH RESEARCH

In the A. O. Smith research laboratory: special collapse-testing apparatus for casing.

A.O. SMITH way

SMITHway CASING · LINE PIPE

A. O. SMITH CORPORATION

New York 17 • Pittsburgh 19 • Atlanta 3 • Chicago 4 • Tulsa 3 • Dallas 1
Houston 2 • Seattle 1 • Los Angeles 14 • International Division: Milwaukee 1

Associations

API Names Miller Director Of Department of Information

Rear Admiral Harold Blaine Miller, USN (retired) has been appointed director of the Department of Information of the American Petroleum Institute.

Harold B. Miller

Formerly public relations officer for Fleet Admiral Nimitz in the Pacific Ocean Area, Miller later was assigned to the Navy Department in Washington as Director of Public Information. Upon his retirement in 1946, Miller became vice president of public relations for Trans World Airline. After this he served as executive director of the Congressional Aviation Policy Board.

In addition to functioning as the director of the API's Department of Information, Admiral Miller will, by request of the Oil Industry Information Committee, of which Ralph C. Champlin of Ethyl Corporation is chairman, serve as executive officer of that committee, which is conducting the information program for the entire oil industry.

Robert E. Allen will continue with the Institute as assistant director of the Department of Information.

Petroleum Equipment Suppliers Elect Four District Chairmen

Results of balloting by the directors of the Petroleum Equipment Suppliers' Association for the chairmen of the four districts has been announced.

Ferd J. Spang, Spang & Company, Butler, Penn., has been elected chairman of the Eastern District; J. L. Shakely, Jones & Laughlin Supply Company, Tulsa, Mid-Continent District; Ralph Neuhaus, Hughes Tool Company, Houston, Southwestern District; and Ted Sutter, Bakers Oil Tools, Inc., Los Angeles, Pacific District.

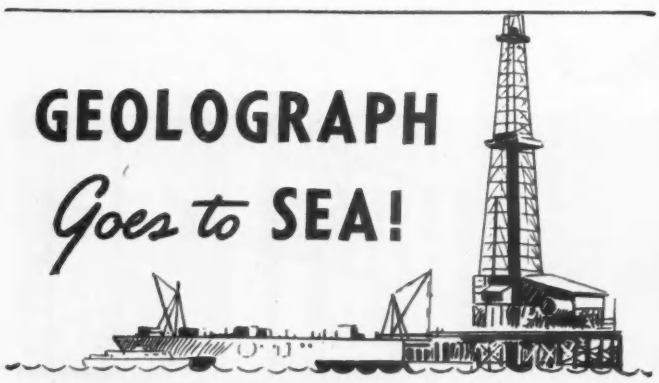
Petroleum Association Names Korte Advertising Manager

Robert Korte, former account executive with Brooks-Keefe advertising agency of Tulsa, has been appointed advertising manager for The Independent Petroleum Association of America.

Robert Korte

Korte, a native Oklahoman, has had wide experience in the advertising and market research fields. He served as public relations officer in the Army Air Forces during the war and upon release from active duty joined the staff of the Tulsa advertising agency. He also served for two years as consultant and research analyst with the firm of Leslie Brooks and associates, specialists in oil field research.

GEOLOGRAPH
Goes to SEA!



You may never drill in the ocean, but wherever you drill, *you* SAVE when *you log as you drill* with Geograph's Mechanical Well Logging Service.

Remember, Geograph's 12-hour charts (3½ x 25½-inches) record not only the formation changes as you drill, but also the exact time of day each foot is drilled . . . and the down time.

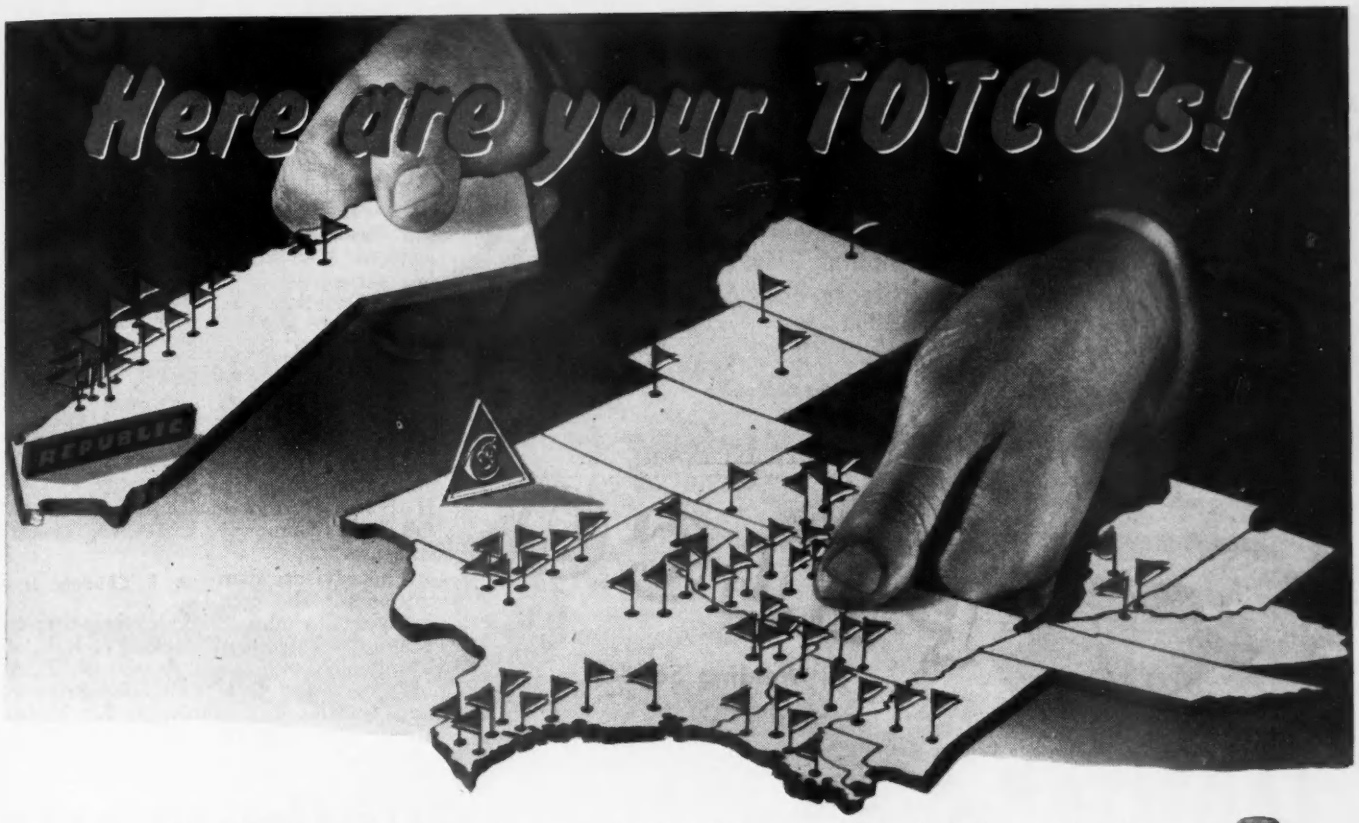
Reasonable rental rates. Write for details.

"TIME WILL TELL"
THE GEOLOGRAPH CO. INC.
P. O. Box 1291 Oklahoma City 1, Okla.

How to do a favor
. . . . *for a friend*

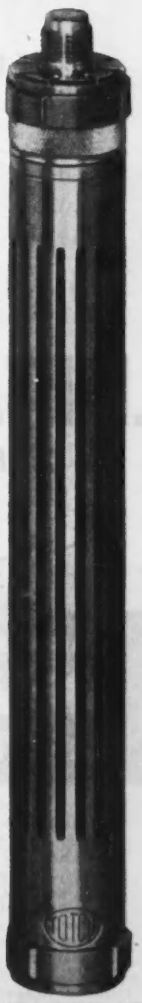
As a reader of WORLD OIL you're familiar with the scores of practical ideas to be found in every issue. Many of your associates would find the information equally helpful. Send us their names, and we'll acquaint them with this easy way of keeping in touch with new developments, improved techniques, and money-saving methods in drilling, producing, and pipe line operations. You'll be doing your friends a favor—we'll appreciate it too!

WORLD OIL
(Established 1916 as The OIL WEEKLY)
P. O. BOX 2608
HOUSTON 1, TEXAS



IN EVERY major oil section of the country, you are never more than a few miles from complete stocks of TOTCO Recording Instruments, Go-Devils, parts and operating equipment . . . all of them now in plentiful supply. In most places a phone call will put what you need — and all you need—in your hands in a matter of minutes!

Look at the map: read the list below, and notice the 67 convenient TOTCO Service Locations. Also, one of Totco's seventeen field engineers, highly trained in Controlled Vertical Drilling techniques, is stationed near you. A call to the service location in your area will bring him to you for consultation.



MID-CONTINENT CONTINENTAL SUPPLY COMPANY STORES

ARKANSAS
- El Dorado
- Magnolia

COLORADO
- Artesia

ILLINOIS
- Salem

WYOMING
- Casper
- Cody

KANSAS
- Eldorado
- Ellinwood
- Liberal
- Pratt
- Russell

LOUISIANA
- Eunice
- Houma
- Jena
- Lake Charles
- New Iberia
- Shreveport

MISSISSIPPI
- Brookhaven
- Laurel
- Natchez

INDIANA
- New Harmony

KENTUCKY
- Henderson

MONTANA
- Cutbank

NEW MEXICO
- Hobbs

OKLAHOMA
- Drumright
- Duncan
- Healdton
- Lindsay
- Oklahoma City
- Perry
- Seminole

TEXAS
- Abilene
- Alice
- Carthage
- Corpus Christi
- El Campo
- Falfurrias
- Frankel City
- Graham
- Houston
- Kermit
- Kilgore
- Longview
- McAllen
- McCamey
- Monahans
- Nocona
- Odessa
- Pampa
- Raymondville
- Refugio
- Sundown
- Wichita Falls
- Winnsboro

CALIFORNIA REPUBLIC SUPPLY CO. STORES
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- Newhall Ranch
- Ventura
- Santa Maria
- Taft
- Bakersfield
- Avenal
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BROWN SERVICE CO.
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TECHNICAL OIL TOOL CORP., Ltd.
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American Petroleum Institute Names Nominating Committee

Members of the committee on nomination of the American Petroleum Institute for 1948 have been announced by William R. Boyd, Jr., president. They are L. S. Wescoat, chairman, The Pure Oil Company, Chicago; James A. Dunn, Barnsdall Oil Company, New York; Eugene Holman, Standard Oil Company (New Jersey), New York; Wm. F. Humphrey, Tide Water Associated Oil Company, San Francisco; H. L. Hunt, Dallas; H. T. Klein, The Texas Company, New York; Chas. F. Roeser, Roeser & Pendleton, Inc., Fort Worth; W. C. Skelly, Skelly Oil Company, Tulsa; R. C. Stoner, Standard Oil Company of California, San Francisco; S. A. Swensrud, Gulf Oil Corporation, Pittsburgh; and A. E. Watts, Sinclair Oil Corporation, New York.

Ponca City Engineers Club Elects Paul Sterba President

Paul E. Sterba, general yard foreman at the Ponca City refinery of Cities Service Oil Company, has been elected president of the Engineers Club of Ponca City, succeeding P. J. Ruckle. Ben Morton, refinery engineer, has been named a vice president of the club.

Childers Elected President of Houston Geological Society

A. F. Childers, Jr., Gulf Oil Corporation, was chosen president of the Houston Geological Society for 1948-49. He has served as secretary for the past year.

A. F. Childers, Jr.

Herschel C. Ferguson was elected vice president; R. R. Ricke, Schlumberger Well Surveying Corporation, secretary; and Miss Mary L. Holland, Stanolind Oil & Gas Company, treasurer.

The advisory committee for the coming year includes A. F. Bauernschmidt, Magnolia Petroleum Company; J. L. P. Campbell, Lane Wells Company; T. A. Meyers, Claud B. Hamill Oil Company; and Charles F. Sample, J. M. Huber Corporation, retiring president, ex-officio member.

National Emergency Committee Named by Petroleum Council

A committee to make plans for meeting petroleum needs in a national emergency has been announced by the National Petroleum Council. The Council was asked by Max W. Ball, director of the oil and gas division of the Department of Interior, to study wartime experience and propose a program to assure essential supplies in time of emergency.

Those named to the national emergency council are B. Brewster Jennings, Socony-Vacuum Oil Company, Inc., New York, chairman; J. R. Parten, Woodley Petroleum Company, Houston, vice chairman; Bruce K. Brown, Standard Oil Company (Indiana), Chicago; H. S. M. Burns, Shell Oil Company, Inc., New York; J. C. Donnell II, The Ohio Oil Company, Findlay, Ohio; B. I. Graves, Tide Water Associated Oil Company, New York; D. A. Hulcy, Lone Star Gas Company, Dallas; J. A. Lentz, Continental Oil Company, Denver; B. L. Majewski, Deep Rock Oil Corporation, Chicago; J. Howard Marshall, Ashland Oil and Refining Company, Inc., Ashland, Ky.; Glenn F. Nielson, Husky Refining Company, Cody, Wyo.; John W. Newton, Magnolia Petroleum Company, Beaumont; S. F. Niness, National Tank Truck Carriers, Inc., Dowington, Penn.; H. J. Porter, Texas Independent Producers and Royalty Owners' Association, Houston; Claude P. Parsons, Spartan Tool Company, Houston; E. E. Pyles, Jergins Oil Company, Long Beach, Calif.; W. R. Reitz, Quaker State Oil Refining Corporation, Oil City, Penn.; W. S. S. Rodgers, The Texas Company, New York; Stribling Snodgrass, Bechtel Corporation, San Francisco; Reese H. Taylor, Union Oil Company of California, Los Angeles; and W. W. Vandeveer, Allied Oil Company, Cleveland.

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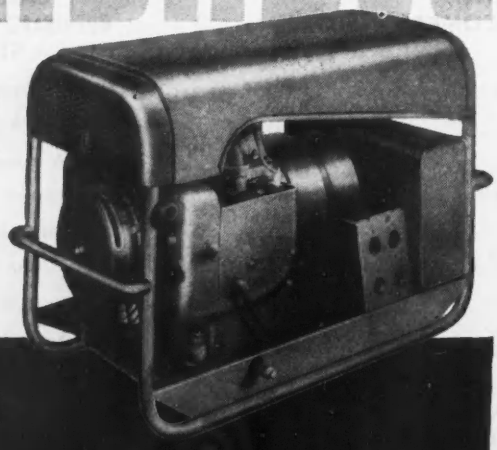
Immediate Delivery — Outlet sizes ¼" to 16"
Order Through Your
Favorite Supply House

PELICAN WELL TOOL & SUPPLY CO.
P. O. Drawer 1108 Shreveport (84), La.

DEPENDABLE

LIGHT & POWER
for Oil Field Service



AIR-COOLED HEAVY-DUTY
ONAN "CK"
ELECTRIC PLANTS

Available in A.C. or D.C. models, conservatively rated at 3,000 watts, built for heavy-duty service but compact and light in weight (only 315 lbs.), Onan CK Electric Plants are replacing bulky, heavier units for drill rigs, well-servicing and other oil field uses. Equipped with convenient carrying frame for easy moving on the job. Driven by the Onan 10 hp, 2-cylinder opposed, air-cooled CK engine with Onan heavy-duty generator direct-connected. Self-rewinding Readi-Pull starter included as standard equipment. Other models available with manual, Readi-Pull or electric starting. Plug-in receptacles. Weather hood, hinged for easy servicing, protects plant.

Models for every oil field job

Lightweight: 500 to 3000 watts

Gas-gaso-powered: 3 to 35KW

Diesel Plants: 2½ to 35KW

Onan PRODUCTS

Heavy-duty, one and two-cylinder air-cooled models. Two, four and six-cylinder water-cooled models. Gas-gaso-powered: 350 to 35,000 watts. Diesel-powered: 2,500 to 35,000 watts.

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D. W. ONAN & SONS INC.
Royalston Ave. Minneapolis 5, Minn.

5340

Murray Rubber

CASING SEAL RINGS

Custom Built

FOR NATIONAL WELL HEADS

Left—A National, 3000-5000 lbs. Working Pressure, Christmas Tree.

The success of any well head depends largely on its ability to effect and maintain a pressure-tight seal of the casing annulus. Failure at this point would result in the equalization of casing pressures, which could (and often does) result in costly remedial operations.

National engineers, recognizing the need for completely dependable well head seals, have entrusted Murray Rubber with the job of producing them.

Whatever your molded rubber requirements may be, Murray engineers will gladly consult with you on how your product can be improved. Experienced oil tool design engineers, together with rubber compounding and molding technicians with nearly a quarter-century of specialized experience to their credit, are at your disposal.

The Murray Tool and Mold Division, which is operated as a part of the Murray Rubber Company, is dedicated to the production of customer's molds, metal inserts, dies, fixtures and other precision machine work to relieve the customer of these production details.

Make Murray your rubber supplier, too!

MURRAY RUBBER COMPANY

HOUSTON, TEXAS

Pennsylvania Grade Crude Oil Association Appoints Youkers

B. E. Youkers of San Francisco, Calif., has joined the staff of the Pennsylvania Grade Crude Oil Association as a special field service representative assigned to the midwestern area. From headquarters in Chicago, he will cover Illinois, Wisconsin, Minnesota, Iowa, Missouri, Arkansas, Nebraska, and possibly other states.

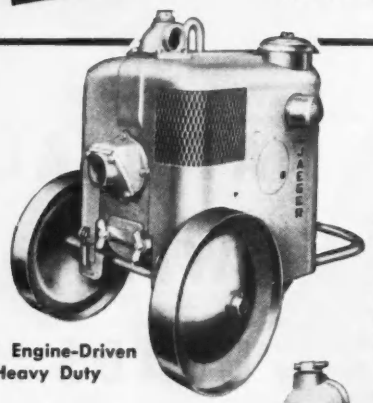
Youkers was employed by Tide Water Associated Oil Company, San Francisco, from 1945 to 1947 as motor check engineer, handling sales and demonstrations of oil and gasoline. More recently he has been regional manager for Clayton Manufacturing Company of El Monte, Calif., manufacturers of dynamometers.

Valerious Elected President

C. N. Valerious, division geologist for Barnsdall Oil Company at Shreveport, La., has been elected president of the Shreveport Geological Society.

another reason why

JAEGER PUMPS
are the kind you need...

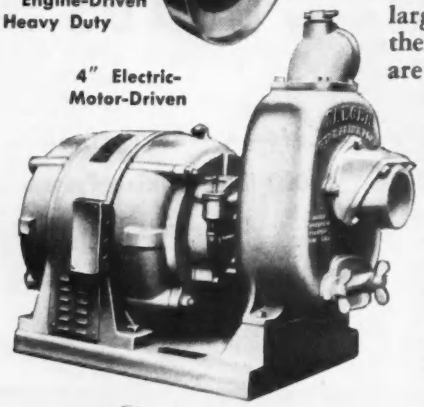


2" Engine-Driven Heavy Duty

No Babying!

They're built to take the gaff of oil and gas field service — designed to steer clear of troubles. Passages have no corners to hold sediment. Impeller blades are open, trash type that pass large solids easily. Discharge starts at the very bottom of pump shell—solids are violently agitated and carried out. Power units bolt directly to pump shells — in positive permanent alignment. Hardened steel liner plates are easily removed and replaced after long service, to renew pump efficiency. Famous Jaeger "Lubri-Seal" seals the shaft against vacuum and pressure losses —is instantly accessible for inspection. And, Jaeger "Sure-Prime" Pumps are available with working parts of semi-steel, bronze or aluminum, to meet unusual conditions. Write for Catalog PF8.

4" Electric-Motor-Driven



4" Engine-Driven Heavy Duty

APPLICATIONS
Drill Rig Water Supply • Tank Transfer
Jetting • Dewatering Pipe Lines
Mud Transfer • Pumping Tank Bottoms
General Dewatering

SIZES
1½ to 10 inches • 3,000 to 240,000 gph

TYPES
Engine and Motor-Driven
Lightweight • Heavy Duty • Jetting
High Pressure • Lift & Force Diaphragm

THE JAEGER MACHINE CO.
FACTORY — Columbus 16, Ohio

REGIONAL OFFICES: 1504 Widener Building, Philadelphia 7, Pa.
226 N. La Salle St., Chicago 1, Ill., 235 American Life Building, Birmingham 1, Ala.

Distributors in 130 Cities in the U. S. and Canada.

John Peirce Succeeds Gilman As Association Secretary

John M. Peirce, economist for the Western Oil and Gas Association for the past three years, has been appointed executive secretary of the Association. He succeeds Don E. Gilman, who resigned recently as executive vice president.

John M. Peirce

Peirce, who has had more than 20 years experience in the field of business economics and taxation, has been serving the Western oil industry as technical consultant on economic problems and related subjects. A native Californian, he formerly was director of the tax department of the California Chamber of Commerce and for 11 years prior to that he was economist and tax counselor for the California Taxpayers Association.

Commission to Study Problem Of Providing Adequate Oil

The problem of providing an adequate oil and gas supply without creating waste in the production will be before the Interstate Oil Compact Commission and its 21 member states at the summer meeting to be held in the Roosevelt Hotel, New York City, August 30 through September 1.

Program for the meeting will be built around the ability of the oil and gas producing states to meet consumer demand, how the demand can be met, and what the general public can do to insure an adequate supply. Committee consisting of Harold C. Ostertag, Attica, N. Y.; Jeff A. Robertson, Topeka, Kansas; Clarence T. Smith, Flora, Ill.; and Rex Belisle, Oklahoma City, was appointed by Governor Beauford H. Jester, Compact chairman, to complete the program details.

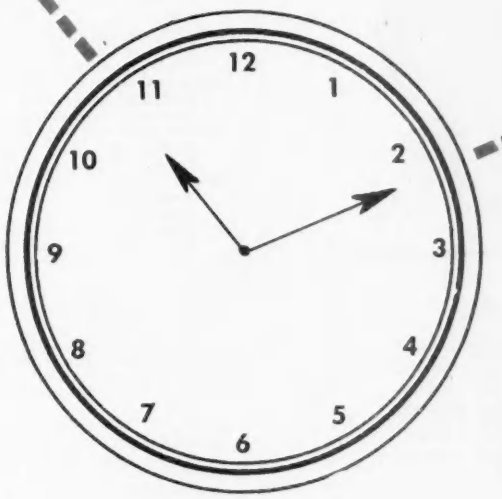
D. T. Ring Reelected President Of Pennsylvania Oil Association

D. T. Ring of Preston Oil Company, Columbus, Ohio, has been reelected president of the Pennsylvania Grade Crude Oil Association for his third one-year term.

Other officers reelected are B. T. Haskins, Ebenezer Oil Company, Wellsville, N. Y., first vice president; George J. Hanks, president of South Penn Oil Company, Bradford, Penn., second vice president; Fayette B. Dow of Washington, D. C., vice president and general counsel; Samuel Messer of Quaker State Oil Refining Corporation, Oil City, Penn., treasurer; Walter R. Reitz of Quaker State Oil Refining Corporation, Oil City, assistant treasurer; C. L. Suhr of The Pennzoil Company, Oil City, assistant treasurer; and W. C. Wenzel of Oil City, executive manager.

PERFECT TIMING

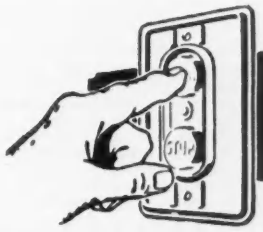
under all conditions...



Another advantage of Low Cost Electric Power

Low cost electric power permits time-clock control of your well . . . dependable assurance that the pumping cycles necessary to secure maximum efficient production will be automatically maintained month after month. Maintenance of proper strokes-per-minute is an added advantage of electric drive. This day-in and day-out, trouble-free performance results in major savings in money and man-hours . . . all advantages obtainable only through use of low-cost electric power.

Electric Power offers you



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VERSATILITY
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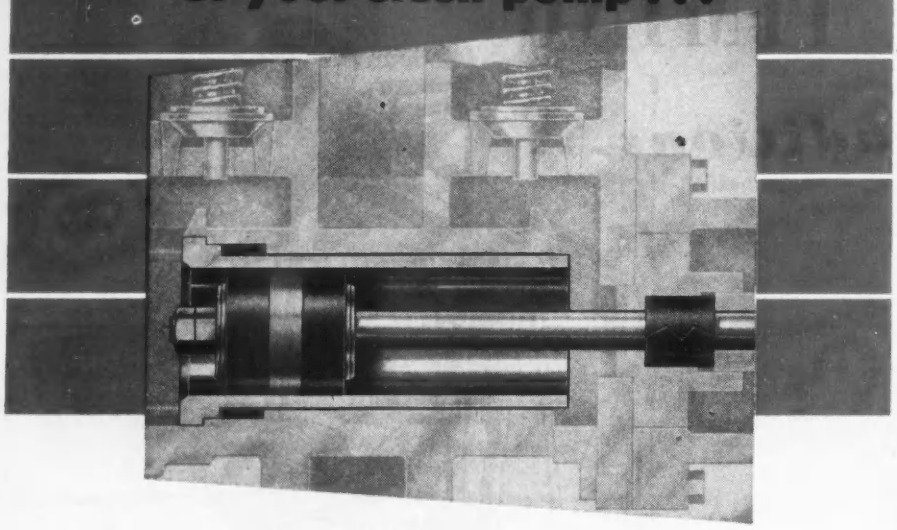
FLEXIBILITY
SIMPLICITY

Protect the "Business End"

of your slush pump . . .



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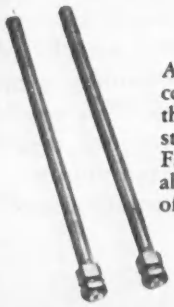
Widespread acceptance of Falcon Products in both domestic and foreign fields is your assurance of satisfactory performance.

FALCON PISTONS

Heavy-duty solid type. Demountable without removing rod or piston hub. Three hub sizes accommodate pistons from 3¾" to 9¼" diameter.

FALCON LINERS

Forged from chrome-moly alloy and specially heat treated to extreme hardness, Falcon Liners are *honed* to a mirro-like microfinish. Liners and Liner Sleeves are available for every principal make of pump.



FALCON RODS

A harder surface and tougher core are achieved by Falcon through use of higher carbon steel and induction hardening. Falcon rods and packing available for all principal makes of pumps.

Sold only through leading supply houses.

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Branch Warehouses: ODESSA • WICHITA FALLS • OKLAHOMA CITY • JEANERETTE, LA. CASPER • RANGELY • BAKERSFIELD, VENTURA & COALINGA, CALIF. • CALGARY, CAN.

Export Representative: Guy E. Daniels, 30 Rockefeller Plaza, New York 20, N. Y.

ASSOCIATIONS

THE OIL MAN'S CALENDAR

Aug. 30 Sept. 1	Appalachian Gas Measurement Short Course, Annual Session, West Virginia University College of Mines, Morgantown, W. Va.
Aug. 30 Sept. 1	Interstate Oil Compact Commission, Summer Meeting, New York.
SEPT.	
1– 2	Oil Industry Information Committee, Minneapolis, Minn.
7– 8	American Bar Association, Section of Mineral Law, Seattle, Wash., Olympic Hotel.
7– 9	American Society of Mechanical Engineers, Fall Meeting, Portland, Ore., Reed College.
12–14	Southwest LP-Gas Convention and Trade Show, Oklahoma City, Skirvin Hotel.
14–16	Pacific Coast Gas Association, Annual Convention, Santa Cruz, Calif., Hotel Casa del Rey.
15–17	American Petroleum Institute, Lubrication Committee, Hotel Traymore, Atlantic City, N. J.
15–17	National Petroleum Association, Hotel Traymore, Atlantic City, N. J.
16–18	National Petroleum Association, Atlantic City, N. J., Hotel Traymore.
27–28	Independent Petroleum Association of America, Annual Meeting, San Antonio, Plaza Hotel.
OCT.	
3– 6	American Society of Mechanical Engineers, Petroleum Division, Amarillo, Texas, Herring Hotel.
4– 6	American Institute of Mining & Metallurgical Engineers, Petroleum Division, Fall Meeting, Dallas, Adolphus Hotel.
4– 9	American Association of Petroleum Geologists, Midyear Meeting Pittsburgh, Pa.
4– 9	American Gas Association, Annual Convention, Technical Section, Atlantic City, Ambassador Hotel.
5– 6	Oil Industry Information Committee, New York.
11–13	American Association of Oilwell Drilling Contractors, Annual Meeting, Houston, Rice Hotel.
13–14	South Dakota Independent Oil Men's Association, Huron, S. Dak., Marvin Hughitt Hotel.
14–15	Indiana Independent Petroleum Association, Fall Convention, Indianapolis, Ind., Hotel Severin.
14–15	Texas Mid-Continent Oil and Gas Association, Annual Meeting, Fort Worth.
14–15	American Institute of Mining & Metallurgical Engineers, Petroleum Division, Fall Meeting, Los Angeles, Elks' Club.
26	Independent Natural Gas Association of America, Annual Meeting, Mayo Hotel, Tulsa.
29–31	West Texas Geological Society, Field Conference, Big Bend Region of Southwest Texas.
NOV.	
3– 4	American Society of Mechanical Engineers, Fuels Division, Green Brier Hotel, White Sulphur Springs, W. Va.
8–11	American Petroleum Institute, Annual Meeting, Chicago, Stevens Hotel.
MAR., 1949	
24–25	New England Gas Association, Boston, Hotel Statler.
APRIL 1949	
13–15	National Petroleum Association, Hotel Traymore, Atlantic City, N. J.

Nomads Chapter monthly meetings: **Los Angeles**, second Wednesday, Jonathan Club, B. M. Landis, Secretary. **Houston**, second Monday, Houston Club, Harry E. Estes, Secretary, Telephone Charter 4-7611. **Dallas**, L. A. Little, Secretary, Telephone Justin 8-1726. **Tulsa**, third Wednesday, Hotel Tulsa, Anthony Gibbon, Secretary, Telephone 3-1844. **New York**, first Monday, Louis Sherry's, Norris Boulden, Secretary, Telephone WIckersham 2-1311, extension 260.

THE CITY NATIONAL BANK
OF HOUSTON

Condensed Statement of Condition As of the Close of Business June 30, 1948

RESOURCES

Cash and Due from Banks	$57,891,354.60	
U. S. Government Bonds	48,678,308.50	
Municipal Bonds & Warrants	755,800.57	
Federal Reserve Bank Stock	240,000.00	$107,565,463.67
Loans and Discounts	42,995,683.63	
Commodity Loans Secured by Warehouse Receipts	3,274,291.35	46,269,974.98
Bank Premises	4,000,000.00	
Furniture and Fixtures	1.00	4,000,001.00
Interest on Securities and other Income Earned—Not Collected		178,162.34
Customers' Liability on Letters of Credit		9,628,251.44
TOTAL RESOURCES		$167,641,853.43

LIABILITIES

Common Stock	$4,000,000.00	
Surplus	4,000,000.00	
Undivided Profits	1,490,736.09	
TOTAL CAPITAL ACCOUNT		$ 9,490,736.09
Reserve Accounts		219,087.21
Liability on Letters of Credit		9,628,251.44
DEPOSITS:		
Individual	$120,062,912.88	
Banks	27,349,530.19	
Government	891,335.62	148,303,778.69
TOTAL LIABILITIES		$167,641,853.43

CAPITAL & SURPL US $8,000,000.00

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J. W. KEELAND
Executive Vice-President
JOHN M. GRIFFITH
First Vice-President
H. L. SADLER
Vice-President
GUY H. HEATH
Vice-President
D. J. EVANS
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J. A. ELKINS, JR.
Vice-President
GEORGE L. NYE
Vice-President
WADE COOPER
Vice-President
W. J. KEITT
Vice-President
W. C. MENASCO
Vice-President
and Cashier
DAVID MAHOOD
Vice-President
FRANK C. GUTHRIE
Vice-President
EBEN D. JUNKIN
Assistant Vice-President
FRED HAMILL
Assistant Vice-President
and Trust Officer
DAVID T. HEDGES
Assistant Vice-President
R. N. McKASKLE
Assistant Cashier
JOSEPH T. VERDINA
Assistant Cashier
LEONARD McGOWAN
Assistant Cashier
JACK PATTERSON
Assistant Cashier

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WHARTON WEEMS

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Men in the Industry NEWS

Hugh L. Patch and **A. E. Wolf** have been elected vice presidents of The Standard Oil Company (Ohio). **Ralph A. Martin** has been named controller of the company and **Carl F. Jordan** has been made assistant vice president. Patch will be vice president in charge of accounting; Wolf vice president in charge of finance; and Jordan assistant vice president reporting to the newly-elected executive vice president, **Clyde T. Foster.** Patch joined Sohio in March of 1931 as an accountant. He has been controller of the Company since March of 1941. Wolf, who for eleven years was in charge of financial research for F. S. Moseley Company, investment bankers of New York and Boston, came to Cleveland in 1940 to set up preparations for financing by Sohio and in 1941 became assistant to the president of the Company. After serving in the Navy during World War II, he returned to Sohio and has been engaged in the financial program of the company since that time. Jordan joined Sohio in 1921 in the treasurer's office and was named head of the budget department for the company in 1936. Martin has been assistant controller of Sohio, which he joined in 1931 when Refiners, Inc., was consolidated with Sohio. In 1943 he succeeded Jordan as manager of the budget department. He became assistant controller in 1945.

G. D. Robertson

A. T. Rylands

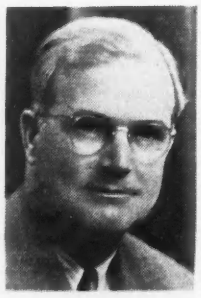
A. T. Rylands, former exploitation engineer in the Oklahoma division, has been named manager of the newly-created Corpus Christi Production Division of Shell Oil Company. The new division was formerly part of Shell's South Texas Production Division, which now has been divided into a Houston division, including the central Gulf Coast, and a Corpus Christi division, including southwest Texas and the lower Gulf Coast. **G. D. Robertson** heads the Houston Division. Members of his staff are **C. H. Taylor,** division production superintendent; **A. K. Korn,** division exploitation engineer; **C. B. Paris,** division chief clerk; **E. V. Hanson,** subsurface engineer; and **S. E. Lamber,** reservoir engineer. Ryland's Corpus Christi staff includes **R. J. Dobson,** division exploitation engineer; **J. T. Briothaupt,** division mechanical engineer; **W. D. Langridge,** division chief clerk; and **R. L. Gibson,** reservoir engineer.

»

Ralph O. Dietler, president of Stanolind Oil Purchasing Company, a subsidiary of Standard Oil Company of Indiana, has been advanced to the newly-created post of chairman of the board and has been succeeded as president by **A. C. Sailstad,** former executive vice president. **D. L. Wolfe,** manager of the executive department, was elected vice president and director. Dietler entered the service of the Midwest Refining Company at Denver, Colo., in 1919 and became assistant to the president in 1928. Three years later he was transferred to Tulsa and became president of Stanolind Oil Purchasing Company in 1940, succeeding the late **Robert W. Ellison.** Sailstad joined the sales department of Standard of Indiana at Duluth in 1934 and the following year was transferred to Chicago as general manager of sales research. He went to Tulsa in 1947 as manager of crude oil purchases for Stanolind Oil Purchasing Company.

»

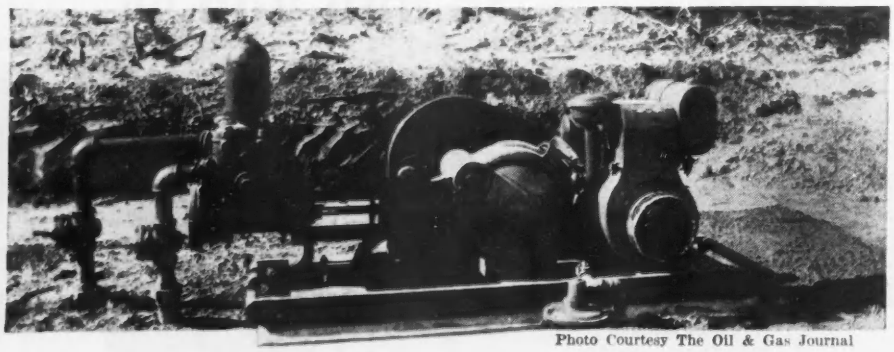
Robert L. Kidd has been elected a vice president of Cities Service Oil Company (Delaware). He has been with the company for 25 years and his first assignment was in the land department. Through the intervening years he has served as resident geologist at Oil Hill, Kansas, chief geophysicist, assistant chief geologist, chief geologist of the company's Bartlesville, Okla., division, and manager of Cities Service Oil Company's Land and Geological Division. He was elected to the company's directorate in February, 1946.



Robert L. Kidd

»

O. G. Martin will retire as vice president and director of Argo Oil Corporation on December 31, 1948, on which date he will have completed thirty years of service with Argo and its predecessor companies. He came to Denver in December, 1918, and entered the employ of The Midwest Refining Company. In February, 1920, he was transferred to Casper, Wyo., where he spent six years with the Western States Oil and Land Company, a Midwest subsidiary. When the Western States Company was merged with Argo Oil Company he was transferred back to Denver in January, 1926. Prior to coming to Colorado, he was employed by a subsidiary of the Gulf Oil Corporation at Tulsa.



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UNITED STATES STEEL

Kenneth H. Crandall, vice chairman of the board of The California Company, has been elected a director of the Standard Oil Company of Texas. Both companies are subsidiaries of Standard Oil Company of California.

Kenneth H. Crandall

Crandall joined The California Company in 1925 and subsequently was placed in charge of all geophysical work for that company and Standard Oil Company of Texas. He then was appointed superintendent of exploration in The California Company and in 1942 was elected director and vice president. He was elected director and president of The California Company in 1945 and last year became vice chairman of the board.

»

Grover E. Murray resigned from Magnolia Petroleum Company on August 1 to accept a position as professor of geology at Louisiana State University. He has been with the Magnolia Company for several years, most recently located at Jackson, Mississippi.

Bruce C. Clardy of Tulsa has been named general manager of crude oil supply and manager of the products pipe line department of Standard Oil Company (Indiana), with his office in Chicago. Clardy, who has just resigned as president of Stanolind Pipe Line Company, served as assistant director of supply and transportation for the Petroleum Administration for War in 1943 and 1944. His specialty was direction of crude allocations to refineries, as well as purchase and sale of crude and products carried by the Big Inch and Little Big Inch pipe lines. His career in the oil industry began with oil field work in Augusta, Kansas, in 1916 Later he became a roustabout for the Jackson company of San Antonio. In 1926 he became supervisor of the oil and gas division of the Texas Railroad Commission. From 1928 to 1936 he was with the Shell Pipe Line Company as district gauger and pipe line foreman and later as manager of the crude oil department. He then went into drilling and producing operations for himself, with the firm of Heyser, Heard, and Clardy, Inc. He continued in such operations up to the time of joining Stanolind.

Bruce C. Clardy

»

J. L. Burke has been elected president of Stanolind Pipe Line Company succeeding **Bruce C. Clardy. J. R. Polston** and **R. J. Andress** have been elected to membership on the Board of Directors. Burke, former executive vice president, became a member of the Board of Directors of Stanolind Pipe Line Company and was elected vice president in charge of traffic in 1946. In 1947, he was elected vice president and became executive vice president in January, 1948. Polston started with the company when it was known as Sinclair Pipe Line Company. He resigned in 1926 to accept employment as construction superintendent with the Marland Oil Company at Ponca City and later worked for the Arthur G. McKee & Company as refinery process design and estimating engineer. In 1934, he returned to Stanolind Pipe Line Company as mechanical engineer and was promoted to assistant general manager in charge of engineering and construction in 1947. Andress, who has been assistant to the vice president or executive vice president since January, 1947, entered the employ of the pipe line company in September, 1946.

»

K. A. Simmons has accepted the position of division manager of the South Texas division of Anderson-Prichard Oil Corporation, with headquarters in San Antonio. Until recently Simmons was chief geologist for Kingwood Oil Company at Oklahoma City. Prior to his connection with Kingwood, Simmons was associated with W. C. McBride, Inc., in South Texas and the Illinois Basin.

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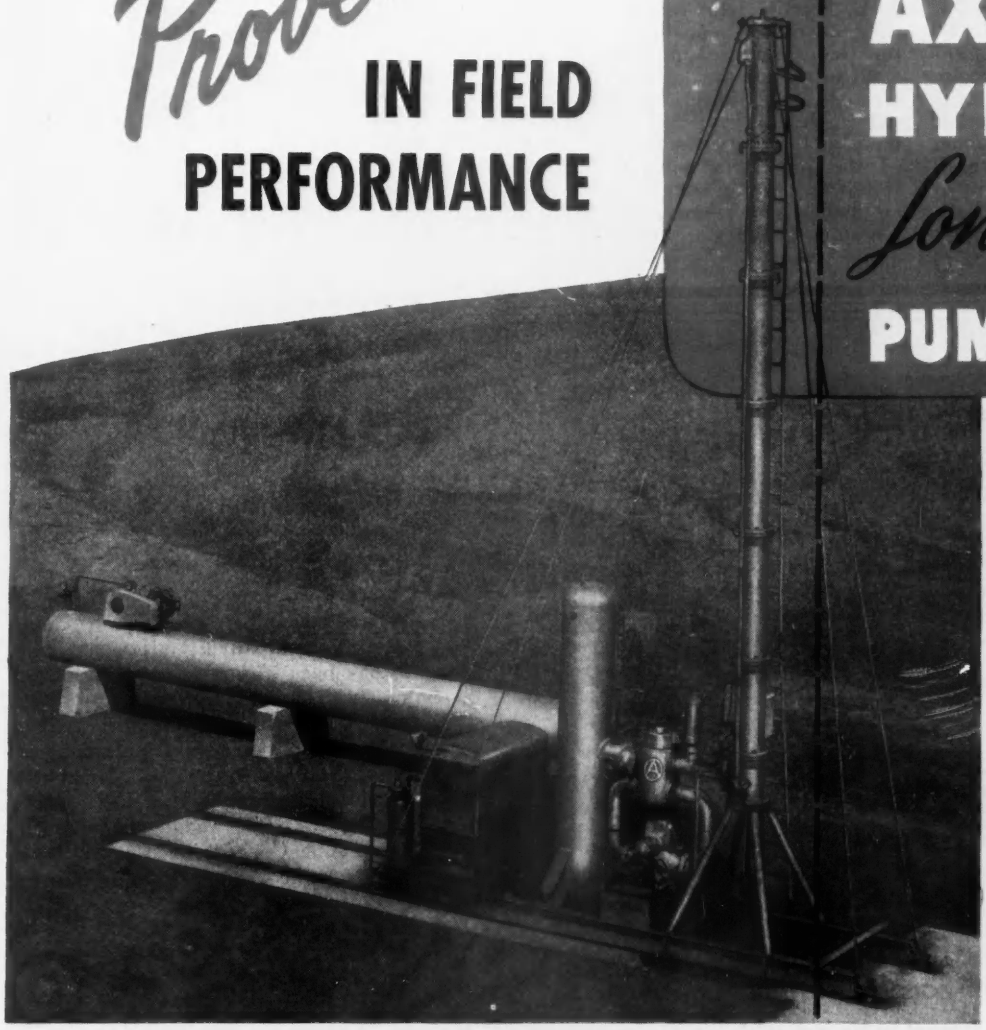

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J. H. Olehy, chief process engineer in Continental Oil Company's manufacturing department, has been promoted to supervisor of technical services, succeeding **L. L. Davis** who was recently named manager of the company-wide development and research department; **J. H. Smith,** technologist, to chief process engineer succeeding Olehy; **B. H. Lincoln,** chief chemist, to patent advisor of the development and research department; **C. A. Neilson,** research chemist, to chief chemist succeeding Lincoln; **Horace E. Luntz,** technologist, to superintendent of the process laboratory, succeeding Neilson; **A. M. Hovlid,** assistant to the manager of the manufacturing department, appointed to newly created position of personnel supervisor, manufacturing department, in addition to present duties.

»

J. L. Martin, who recently was named director of the pipe line department of the General Petroleum Corporation and a director of the company, has been elected a vice president of the company. Martin came to General Petroleum in 1913 as assistant superintendent of the pipe line department at Taft, following pipe line experience with other companies in Missouri, Illinois, Indiana, Oklahoma, and California.

W. L. Kygar has been promoted to the newly created position of assistant manager of Continental Oil Company's motor transportation division. In his new position Kygar, who was formerly assistant manager of the production and drilling department, will serve under the direction of **Col. T. D. Harris,** manager of motor transportation. Kygar joined Continental 22 years ago as a meterman for the Ponca City Distributing Company, a subsidiary. He was transferred to Continental's pipe line accounting division in 1928 and after holding various positions in that division he was promoted to chief clerk in 1930. Kygar was promoted to chief clerk of the production and drilling department in 1935 and was named assistant to the manager in 1936. He was appointed assistant manager in May, 1943.

W. L. Kygar

»

George S. Buchanan, manager of Sohio Petroleum Company's Gulf Coast division, has been elected vice president of Sohio in charge of land and exploration activities. He will maintain his staff in Houston, supervising his new duties through division offices in Oklahoma City and Evansville, Ind. Before joining Sohio in 1945, Buchanan was president of the Yegua Corporation. He is also a director of the Atlas Oil and Refining Corporation and vice president of the Wescol Oil and Gas Company.

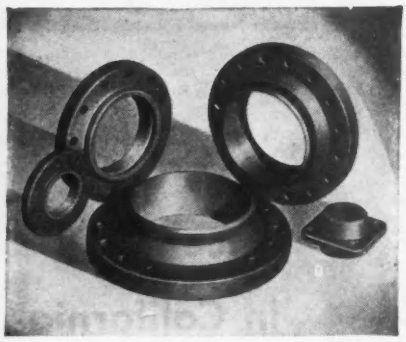
»

Reese H. Tucker of Tulsa has resigned as president of the Tucker Exploration Company to accept the newly-created post of manager of geophysics for Cities Service Oil Company at Bartlesville, Okla. Tucker was first employed by Cities Service in 1930 as junior engineer. He resigned in 1940 to form Tucker Exploration Company, which will now be liquidated as soon as contract obligations are satisfied.

Reese H. Tucker

»

Dr. Haldon A. Leedy, acting director of Armour Research Foundation of Illinois Institute of Technology, has been named director. He succeeds **Dr. Jesse E. Hobson,** who went to California as director of the Stanford Research Institute. As director of Armour Research Foundation, Dr. Leedy administers the widespread industrial research program conducted by his division of Illinois Institute of Technology.



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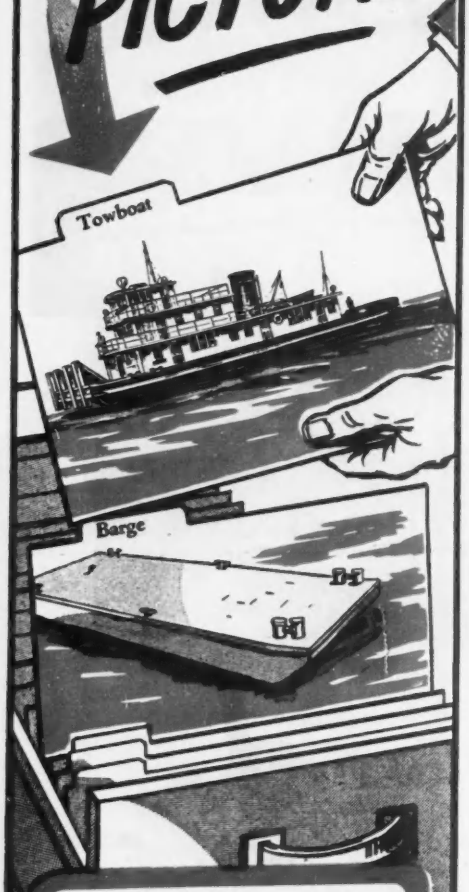

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E. V. "Jim" Watts has been promoted to assistant to the superintendent of the Southern Division of General Petroleum Corporation. **Don B. Priest** has been named to be assistant to the superintendent of the Coastal Division and **A. F. Barrett,** assistant manager of Rocky

E. V. Watts

G. H. Supple

Mountain operations with headquarters at Casper, Wyo. **G. H. Supple,** who has been with the company 23 years, has been named manager of the pipe line department. **Laurence Andrew,** a 35-year veteran, has been appointed general superintendent of the department.

Other appointments of veteran employes are those of **V. C. Larsen** to be assistant general superintendent; **C. W. House,** to be superintendent of the northern division with headquarters at Taft; and **L. L. Tarne,** to be assistant superintendent of the southern division.

»

E. O. Perkins, general superintendent of the Terminal Division of The Texas Company since 1944, has been appointed assistant general manager of the company's Marine department. **Joseph T. Froehlich** succeeds Perkins as general superintendent of terminals. Perkins started with Texaco in 1920 as a stenographer at the company's refinery in Port Arthur, Texas. He was transferred to the Terminal Division in 1931. Froehlich began his business career with The Texas Company in 1929 as a draftsman in the Engineering Department and became assistant general superintendent of terminals in 1944.

»

Millard K. Neptune of Oklahoma City has resigned as assistant manager of the West Edmond Hunton Lime Unit to accept the newly-created position of industrial engineer for Continental Oil Company in Ponca City, Okla. He has been assigned temporarily to the production and drilling department to assist in organizational work. Neptune was formerly associated with Phillips Petroleum Company in various positions from roustabout to assistant manager of the Phillips Venezuelan Oil Company and served for three years during the war as assistant to the Director of Production, Petroleum Administration for War.

Millard K. Neptune

Walter E. Caine has resigned as director of the Bureau of Statistics and secretary of the Accounting Section of the American Gas Association to become secretary and treasurer of Texas Eastern Transmission Corporation. He assumed his new duties August 1 and is located in Texas Eastern's headquarters at Shreveport, La. Caine received his master's degree in Business Administration from Northwestern University in 1931 and immediately entered the public utility field, serving for a year with a special committee appointed by Governor LaFollette of Wisconsin to survey the power resources of the state. From 1932 to 1938 he was associated with the Wisconsin Public Service Commission and then joined the Federal Power Commission where he became assistant chief of the Division of Rates and Research. Shortly thereafter, J. A. Krug, then director of the Power Division, Office of Production Management, borrowed his services and appointed him chief of the Negotiations Section. From October, 1942, until September, 1944, when he joined the American Gas Association's staff, Caine devoted full time to supervision of the FPC's war power contract program.

»

E. R. Peterson has been appointed a vice president of Standard Oil Company of California. For the past several years, Peterson has served as secretary of the company's executive committee and has performed confidential analysis for the executive staff. He joined Standard in 1923 and served in the Marketing Department until 1936, when he was attached to the executive staff as a general assistant.

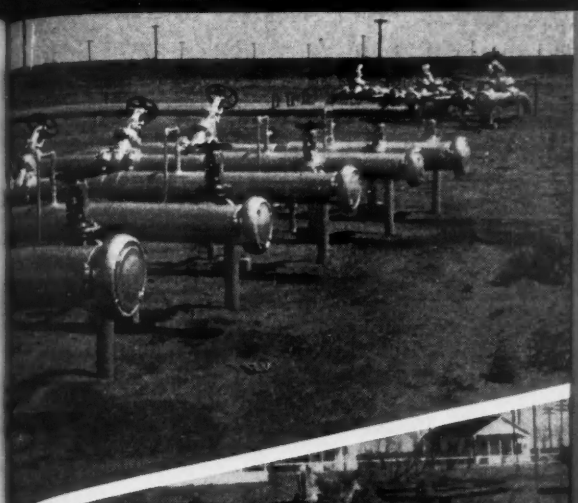
E. R. Peterson

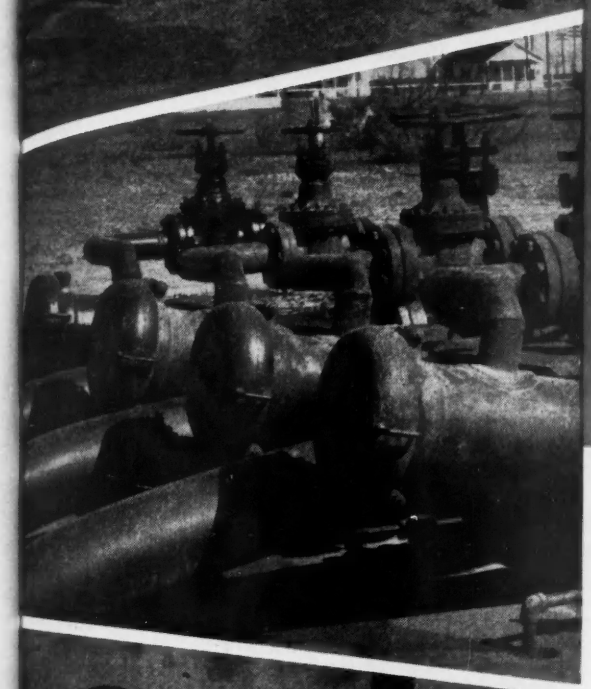
»

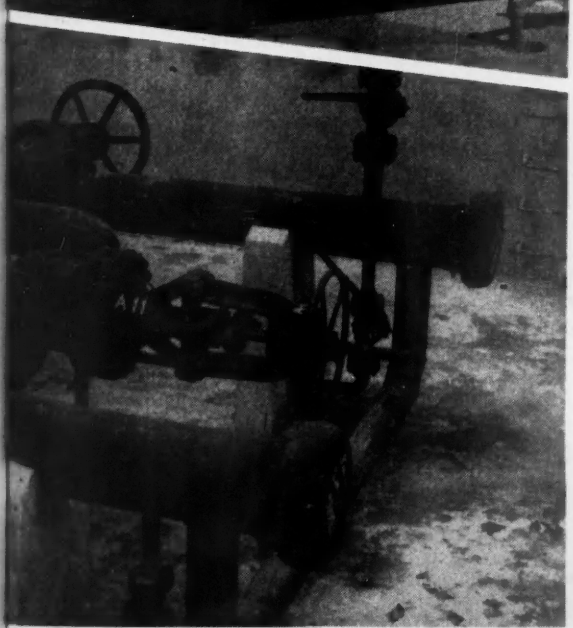
Paul L. Harwood has been appointed assistant manager of the Crude Oil Purchases and Sales Division of The Texas Company, with headquarters in New York. **Doyle Grogan** of Tulsa, formerly with the Texas Pipe Line Company, has been assigned as representative of the division in Kansas. Harwood, who was formerly in the company's purchasing department, has been employed by The Texas Company since 1931, when he was graduated from Harvard Business School. Grogan has been with The Texas Pipe Line Company since 1936, before which he worked in the oil fields.

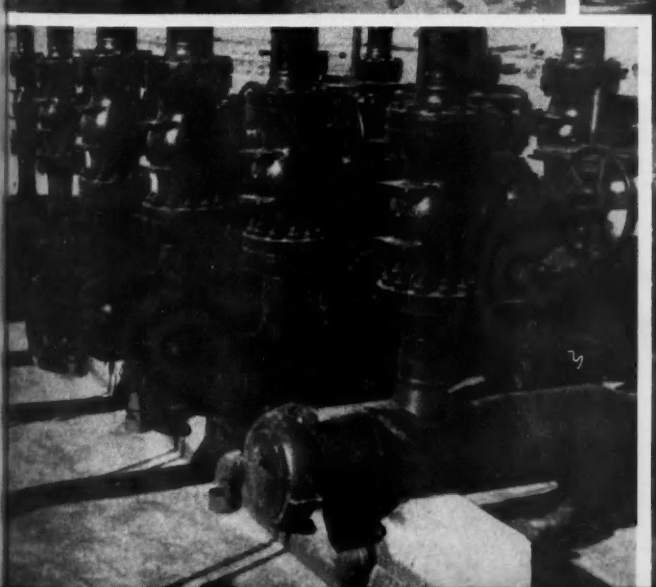
»

Hugh Roy Cullen, Houston oil operator, has announced that his foundation will give an additional $1 million to the Cullen Nurses Home of Memorial Hospital in Houston during the next four years to apply to the cost of the $2 million building. The nurses' home, originally made possible by a $1 million gift from Mr. and Mrs. Cullen, was dedicated July 3.









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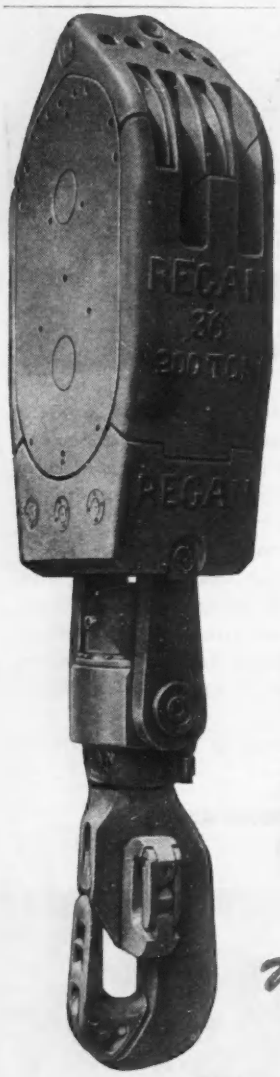
Anthony Banks, who once was a New York bank messenger, has been appointed assistant treasurer of The Texas Company with offices in the company's Houston building. Banks replaced **J. P. McKenna,** who has returned to the New York office to assume charge of domestic banking matters. Banks joined The Texas Company in 1927 as a hall boy in the New York office and soon advanced to other jobs. He served in the army from 1941 to 1946, when he returned to the company and was promoted to assistant to management of the Treasury Department, Banking Division, New York.

Frank C. Barnes has recently been appointed to the New Mexico Oil Conservation Commission, Santa Fe, as geologist. Before joining the Commission, Barnes did consulting work in the Rocky Mountain Area and the San Juan Basin of Colorado and New Mexico. He has also been associated with Shell Oil Company, Inc., U. S. Bureau of Mines, U. S. Geological Survey, and American Smelting & Refining Company. **H. N. Sweeney,** engineer with the New Mexico Oil Conservation Commission, is being stationed at Hobbs to assist in handling the work of the Commission in the Lea County area. Sweeney was formerly sales engineer for the Eaton Metal Products Company and at one time was employed by the Home Insurance company of New York to inspect drilling rigs for insurance purposes. In 1940, Sweeney was employed by Kenneth Murchison of Dallas and then came to New Mexico in 1945 to found the Butane Gas Company of New Mexico at Santa Fe.



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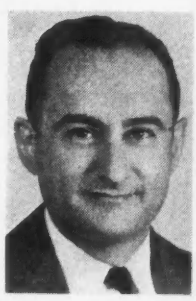
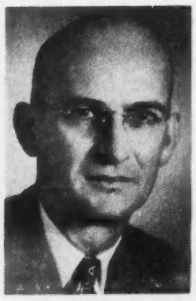
Sol Smith, senior engineer in the Gas Department, Oil and Gas Division, Railroad Commission of Texas, has tendered his resignation to enter private practice in consulting petroleum and natural gas engineering. He will endeavor to devote most of his practice to the problems confronting the rapidly expanding natural gas industry. Smith will open offices in the Brown Building in Austin and will specialize in gas reserves, reservoir studies, gas proration, and various oil and gas well problems. He has served with the Commission for over seven years, during which time he was district engineer of the Pampa and Wichita Falls offices and senior engineer in Austin. He has also had varied experience in oil and gas production and transmission problems with the Magnolia Petroleum Company as district engineer on the Gulf Coast and served three years with the Federal Government during the war in Chemical Warfare Service.



Sol Smith

N. R. Shade and **Frank B. Carter** have been appointed assistants to the director of exploration of the geological department of General Petroleum Corporation at the company's home office in Los Angeles. **E. L. De Maris** has been promoted to supervisor of exploration there. **Victor H. King** has been named supervisor of exploration in the Rocky Mountain Division with headquarters at Casper, Wyo.

E. Floyd Miller has resigned as chief geologist for A. G. Oliphant, Tulsa, and has joined Phillips Petroleum Company to take charge of that company's newly opened Tulsa offices and to act as special representative over Phillips' entire operating territory. Miller has been chief geologist for Bay Oil Corporation, now A. G. Oliphant, since 1933 and has been affiliated with the petroleum industry as a geologist since 1917.



E. Floyd Miller

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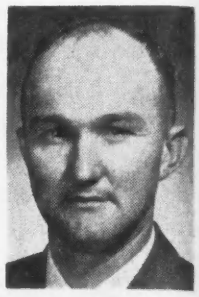
O. C. Schorp, president of The Carter Oil Company, has been named to the board of trustees of the University of Tulsa. Schorp, a Tulsa resident since 1939, was elected to serve for a three-year term. He is also serving as a member of the board of the University of Oklahoma Foundation at Norman.

O. C. Schorp

Francis M. Smith has been appointed a member of the Foreign Trade Committee of the Socony-Vacuum Oil Company, Inc. Smith, who will represent the Middle East division, succeeds **F. H. Henry,** who retired July 1. Smith joined the company as an accountant in Istanbul. From 1922 to 1941, he was in Yugoslavia, first as assistant general manager of the company's marketing operations and later as general manager. When Socony-Vacuum's activities were interrupted by the war, he returned to the U. S. to join the New England Marketing division. He returned to Yugoslavia in 1945 and later went to Greece.

Frank M. Pool, consulting petroleum engineer, has become associated with **Al P. Groebl** and **Virgil J. Powell,** independent oil producers in San Angelo, with offices in the San Angelo National Bank Building. Pool is a graduate of Texas A&M College. He was employed by Humble Oil & Refining Company as roughneck and later junior petroleum engineer until he entered the army in 1942. He returned to Humble in 1945 as district engineer.



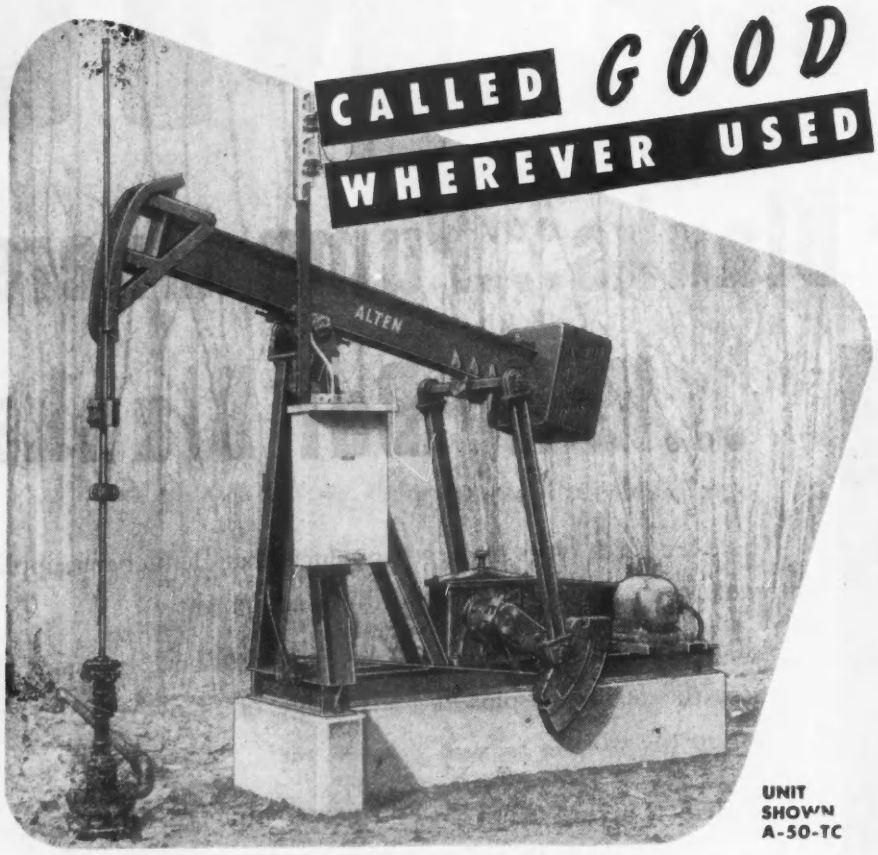
Frank M. Pool

John G. Staudt and **W. E. Reardon** of Tulsa have been named to the board of directors of Dowell Incorporated. Staudt is vice president and general manager of the company and Reardon is assistant general manager. Staudt joined the company in 1932 and has been successively district manager in West Texas, research engineer, assistant manager, and general manager and vice-president.

Transfers:

L. F. Less, geologist for Phillips Petroleum Company at Tyler, Texas, has been transferred to Jackson, Miss. . . . **Fern Fuson,** Ashland Oil and Refining Company, from Wichita Falls, Texas to new offices in Shreveport, La. . . . **A. F. Holland** and **W. P. Whitmore,** Skelly Oil Company engineers in New Mexico and the Velma district, respectively, to Tulsa . . . **W. O. Ham,** district geologist for Continental Oil Company, from Fort Worth to Abilene, Texas . . . **J. B. Armour,** engineer with Stanolind Oil and Gas Company, from Midwest, Wyo., to Oklahoma City . . . **H. H. Wagner,** field superintendent of Turtle Bay area, from Liberty, Texas, to South Houston. **T. E. Keefer,** superintendent of Hastings field, from Alvin, Texas, to Luby area at Robstown, Texas. **D. R. Blocker,** field superintendent at South Houston to Alvin . . . **L. H. Simpson,** superintendent for Helmerich and Payne, Inc., from Brookhaven, Miss., to Chickasha, Okla. . . . **Claude A. Teel,** Skelly Oil Company scout from Jackson, Miss., to Midland, Texas, to replace **Ray Kizzard,** who goes to Shreveport . . . **William C. Allbright, Jr.,** scout for The Atlantic Refining Company, from Mississippi to Casper, Wyo. . . . **Ralph D. Stauffer, Jr.,** scout for Sinclair-Wyoming Oil Company, to Casper, Wyo. . . . **C. C. Shreve,** Sunray Oil Corporation division superintendent, from Allen, Okla., to Great Bend, Kan., to succeed **F. D. Sabourin,** resigned. **Lee Pruitt,** district engineer of northern and western Oklahoma division, Oklahoma City, to north and west Texas division, Odessa, Texas. **Dudley Strother,** engineer at Oklahoma City, to Great Bend, Kan. . . . **A. M. Rentz** and **D. B. Warner,** engineers at Stanolind Oil and Gas Company's gasoline plant at Salt Creek, Wyo., to the manufacturing department of the company's general office at Tulsa.

ALTEN UNIT PUMPERS



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Quality Features Include:

★ High-Capacity Double-Reduction Gear Reducer. Chrome-Nickel Steel Pinions. Hardened Steel Gears. Helical Shaved Gearing. Roller Bearing Equipped Throughout.

★ Double-Row, Spherical Self-Aligning Wrist Pin and Equalizer Roller Bearings.

★ Rigid, All-Welded, Structural Steel Samson Post and Frame.

★ Adjustable Stroke Lengths, Effective Balancing, For Use With Gas Engine or Electric Motor.

★ High Efficiency. Weatherproof Construction.

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Complete Pumping Unit Specifications Also illustrates Alten Casing Heads, Stuffing Boxes, Stop Cocks and hundreds of other production items

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For every phase of OIL FIELD HAULING

All over the globe . . . wherever there's oil . . . no matter how tough the terrain—you'll find rugged Mack trucks giving masterful performance; winning stand-out preference with leading oil field operators.

For every phase of oil field hauling, there's a Mack truck sized right and built right to do the job as only a Mack can do it — with unmatched economy and enduring reliability. Macks are in there every step of the way . . . hauling scientific exploration equipment, carrying drill rigs, cementing units, draw works, casing, boilers, power units — whenever the load calls for greater capacity, power, strength and flexibility.

Macks have established an outstanding record in oil field work because they bring to the job advantages offered by no other truck. Powerful Thermodyne engines! Hydraulic Power Steering! Air Assist Clutch! Mack's famed Balanced Bogie and Power Divider! All are Mack exclusives that assure power and strength for the heaviest loads; flotation and traction for the most slippery mud or sand.

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Mack Trucks, Inc., Empire State Building, New York 1, New York. Factories at Allentown, Pa.; Plainfield, N. J.; New Brunswick, N. J.; Long Island City, N. Y. Factory branches and dealers in all principal cities for service and parts. In Canada, Mack Trucks of Canada, Ltd.

8307

A. S. Angus, 51, and **Hugh McCloskey,** 32, were killed in the crash of a DC-6 passenger plane at Mount Carmel, Penn., on June 17. They were employees of The Texas Company. Angus was manager of the operations division of the Marine Department and had served with the company in various capacities for 29 years. McCloskey was an attorney for the company, having joined them in 1944. He was previously employed by the U. S. Department of Labor.

»

F. R. Campbell, 60, former industrial relations supervisor for The Texas Company's refinery at Tulsa, died June 26. He had a 30-year record for continuous employment with Texaco before his retirement 2½ years ago.

DEATHS

Dr. Robert W. Clark, chief geologist for Western Gulf Oil Company, died at his home in Arcadia, Calif., June 5. He came to California from the Gulf Oil Corporation, Pittsburgh, in 1938 to head the geological department of Western Gulf Oil Company and has been active in the affairs and problems of California geologists in their search for oil since that time. Previous to coming to the west coast, he was engaged in petroleum consulting work in the oil areas of Oklahoma.

Edward H. Leroux, 73, of Tulsa, former president of Oklahoma Pipe Line Company, died June 6. He joined the Oklahoma Pipe Line Company in 1909 after serving his apprenticeship in his father's oil business in Pennsylvania. Through a series of promotions he became president of the firm, holding that position until ten years ago when he retired from active business.

»

Edgar Bogardus, who had been associated with Standard Oil Company (Indiana) for 45 years, died June 21 in Chicago. Bogardus joined Standard of Indiana in 1890 when the company was one year old. For many years he was traffic manager and in 1920 he became assistant to the vice president in charge of sales as a specialist on prices and sales volume.

»

Carl M. Anderson, director of engineering for Dresser Corporation since 1944, died May 22 at Cleveland. Prior to his association with Dresser, he was chief engineer for American Well and Prospecting at Corsicana, Texas.

»

Claude F. Tingley, 70, prominent Tulsa oil man and secretary of the Sand Springs Home, died June 15. A resident of Tulsa for 46 years, he opened a business college there in 1902 and later became affiliated with the late Charles Page, oil operator and philanthropist-founder of the Sand Springs home. He engaged in banking for many years and acquired extensive oil holdings in the Mid-Continent area.

»

Roy W. McLeod, 73, pioneer Oklahoma oil man and president of the Armstrong and McLeod Company, died June 7 at his home in Tulsa.

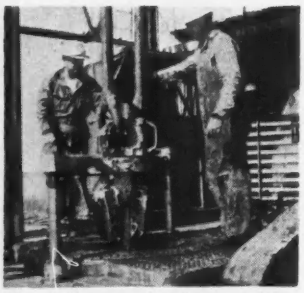
»

A. H. (Bert) Neilson, president and owner of the Neilson Manufacturing Company, Tulsa, well-known oil specialties inventor and designer, died in a Tulsa hospital June 24. A veteran of World War I and formerly associated with Gulf Oil Corporation, he established his own business 25 years ago and is credited with more than 50 patents on oil field equipment, including the Neilson safety hook for pulling casing and tubing, a reversible socket, oil well fishing tools, and a tubing spider.

»

William F. Hart, 65, of The National Supply Company, who served as assistant to the chief of the industrial division of the Pittsburgh Ordnance District in World War II, died July 1 in Cleveland. Hart began his career in the accounting department of the National Tube Company after his graduation from college. He became associated with Central Tube Company in 1909 as general manager and later as a vice president. He was president of the Verona Tool Works, Verona, Pa., from 1920 until 1927, when he resigned to become the first manager of Tubular Sales for the Bethlehem Steel Company. He resigned this post in 1931 to do research work for Weirton Steel Company. He had been associated with National Supply Company since 1940.

DeCo Power Slips ARE BALANCED

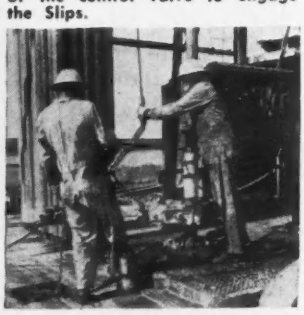


The driller has let down a joint of pipe . . . now a quick touch of the control valve to engage the Slips.

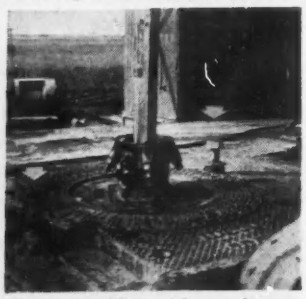
SPEED For ECONOMY SAFETY

FASTER, SMOOTHER ROUND TRIPS

DeCo Power Slips are "Balanced" by two operating pistons on opposite sides of the rotary . . . equalizing weight on each side, assuring perfect centering, allowing extra safety for floormen by eliminating hand slips, and minimizing the number of working parts for simplicity of operation.
The driller's coordinated operation of DeCo Slips with elevator and brake settings means faster, smoother, less costly round trips. The Slips handle all sizes of pipe or casing from 2⅜" to 7".



While floormen make up or break out a joint of pipe, note the low setting of the DeCo Slips allowing more working space.



The DeCo Slip spider and arms are removed with no obstruction to hamper operations. Air pistons are down out of the way.

DeCo Slips are alternately set and raised by a single air pressure valve on the floor at the driller's position.

THE DELANEY COMPANY

Steel Fabricating-DeCoForged Steel Well Head Equipment-DeCo Power Slips-Forgings

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Compare performance of....

CORING WITH DIAMONDS

IN THE WEBER SANDSTONE AT RANGELY

COMPARATIVE CORE RECORDS*

	DIAMOND HEAD	CONVENTIONAL BARREL AND BITS
Weber section cored (ft.)	485	433
Core recovery (ft.)	484.36	398.08
Core recovery (%)	99.89	91.93
Number cores cut	22	57
Average cut per core (ft.)	23.81	7.59
Total cutting time (hr.)	98.84	614.1
Total reaming time (hr.)	0	166.62
Total trip time (hr.)	143.9	675
Core time per foot (min.)	11.97	110.31
Number core bits	4	57
Avg. cut per head (ft.)	115.3	7.59

*Diamond-bit Coring, Neil Williams. *Oil & Gas Journal*, 1/4/47

THE WEBER IS TOUGH. The Weber sandstone at Rangely field in Colorado presented so many problems that until diamond coring was attempted, very little was known of the reservoir. The formation "is a thick section of very hard, fine-grained, tight sand interbedded with hard shale and lime and containing micaceous and arkosic depositions with a secondary cementation of calcite and silica."*

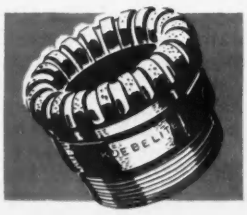
FOR BEST RESULTS, USE THIS MAGIC COMBINATION

KOEBELITE

DIAMOND INSERT CORE BITS

BLACK MAGIC

OIL BASE DRILLING FLUID



KOEBELITE CORING

reduces hours to minutes

Operators using Koebelite diamond core bits in the Weber made 11 cores in two wells for a total of 549 feet. Recovery was 100%. Core time averaged from 6.7 to 13.6 minutes per foot, where formerly footage had been computed in hours. Total diamond cost of the 549 feet was only $764.15 or $1.40 per foot.** Diamond coring programs required 6 to 8 days or one-sixth the time of conventional methods. Worn inserts can be replaced on Koebelite bits and many have cored over one thousand feet in the worst abrasive sands ever encountered.

BLACK MAGIC

makes diamond coring possible

Because Black Magic oil base drilling fluid is not adversely affected by the reduced circulating rates required by diamond coring, it is now adopted as the standard medium in diamond coring programs. Mud conditioning is no longer necessary. Black Magic keeps a hole to gauge, another prime factor in successful diamond coring. It has a filtrate loss of zero in one hour on the API tester and will not damage or water block the producing section. Lubricating qualities of Black Magic save equipment, prevent fluid erosion on the matrix of Koebelite bits and prevent jamming of core barrels.

Coring the Weber by conventional means averaged 40 to 50 days. Conventional core bits were used up at an alarming rate. Time for coring one foot often ran over two hours. Frequent round trips slowed the program. Reaming was necessary. Costs were prohibitive. Something better was needed. Results of coring with diamonds have been tabulated in the above chart. Since then, many improvements have been added.

For complete information on coring with diamonds contact your nearest Oil Base, Inc., office or write the main office. Export representatives: Petro-Tech Service Company, Maracaibo, Venezuela; G. Saavedra E Hijos, S. de R. L., Mexico City, Mexico.

☆ ☆ ☆

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Main Office: 130 Oris Street, Compton, Calif.
BRANCHES: Bakersfield, Long Beach, Ventura, CALIF.; Houston 2, Midland, TEXAS; Oklahoma City 2, OKLA.; Vernal, UTAH.

DISTRIBUTORS FOR KOEBELITE DIAMOND BITS

**Drilling with Diamonds H. C. Arnold, *Oil Reporter*, 4/20/48.

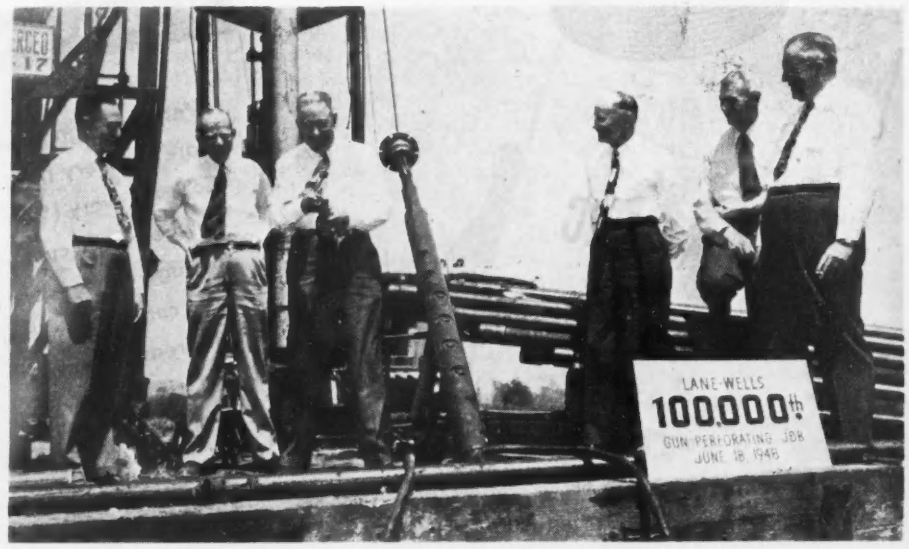
EQUIPMENT AND SERVICE SUPPLIERS' NOTES

The National Supply Company Opens Store and Warehouse in Bakersfield

Recent completion of a new store and warehouse at Bakersfield, Calif., was announced by The National Supply Company with an open house to which more than 2000 oil producers in the district were invited.

The new Bakersfield store, which triples the former capacity, is one of the largest and most complete of its type in the United States, according to J. L. Philipp, district manager at Bakersfield. Its opening was arranged to give district oil men an opportunity to acquaint themselves with the new and improved facilities and to see a specially arranged display of drilling and producing equipment manufactured by National Supply Company and several other suppliers' products that are handled through National's stores throughout the U. S.

D. S. Faulkner, vice president in charge of the California Division, Torrance, Calif., was present to welcome guests. Among many other National Supply executives present were J. R. Mahan, director of engineering, Toledo; F. J. Young, chief engineer, Torrance; C. T. Reichert, division sales manager for the Oil Field Machinery and Equipment Division, Torrance; L. L. Livesley, regional manager for the Superior Engine Division and W. W. Giles.



Officials of Union Oil Company and Lane-Wells Company look on as Walter T. Wells, chairman of the board of Lane-Wells, readies the champagne for the 100,000th Lane-Wells gun perforating job. Left to right are Sam Grinsfelder and W. S. Eggleston, Union Oil; Walter Wells and George Turechek, Lane-Wells; H. E. Winter, Union Oil; and Rodney S. Durkee, Lane-Wells.

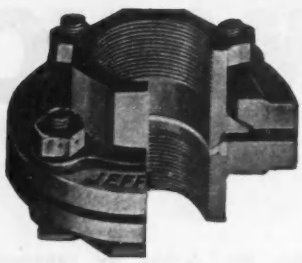
Lane-Wells Company Celebrates 100,000th Gun Perforating Job

The completion of the 100,000th gun perforating job done by the Lane-Wells Company was celebrated with a cocktail party at the Biltmore Hotel in Los Angeles on June 18. The 100,000th job was on Union Oil Company's La Merced No. 17, the same well on which Lane-Wells had done its first gun perforating job 15½ years ago.

Many of the men who watched this 100,000th job were also present at the first perforating job in December, 1932. A. C. Rubel and H. E. Winter, who were present for Union Oil, had okayed and superintended that first Lane-Wells job for Union Oil. Walter Wells, now chairman of the board of the Lane-Wells Company, had been at the first job, watching the first actual field test of the gun perforator he had worked hard to develop. George F. Turechek, Lane-Wells' chief design engineer, not only engineered that first gun, but shot the first job on La Merced No. 17. And "Bill" Allen, "Doc" Stewart and "Marty" Reitzel, who shot this 100,000th job, had been in the crew that shot that first job, fifteen and a half years before.

During the fifteen and a half years since then, on its first 100,000 jobs, Lane-Wells has fired more than 5,000,000 bullets, nearly all of which penetrated the casing and the formation to hang up an enviable record of 97 percent gun perforating efficiency. No possible estimate can be made of the steel saved by use of single string completions made possible by gun perforating, but it is admittedly very great. However, it has been estimated that gun perforating has been responsible for the production of over 200 million barrels of oil which would have been unrecoverable by any other method of completion.

Jefferson Malleable Unions



STYLE "B"

JEFFERSON Style "B" three-piece flange union is made with brass-to-iron and iron-to-iron seats. Being made of highly refined AIR FURNACE iron, it assures you of lightweight construction, perfect ball joint, and positive seating arrangement, whether or not in alignment.

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HYDRAULIC PRESSURE RATING

Sizes	Test Pres.	O. W. G.	S.W.P.-550 Deg
½" thru 4"	2000#	800#	250#
5" and 6"	1200#	500#	250#
8" and 10"	1000#	400#	250#

Malleable iron used in all JEFFERSON unions meets ASTM-4733, Grade 35018—M. T. 53000 Lbs., giving 75%-more elongation 50%-more impact value and is 30%-stronger than cupola malleable iron.

Obtainable through your jobber

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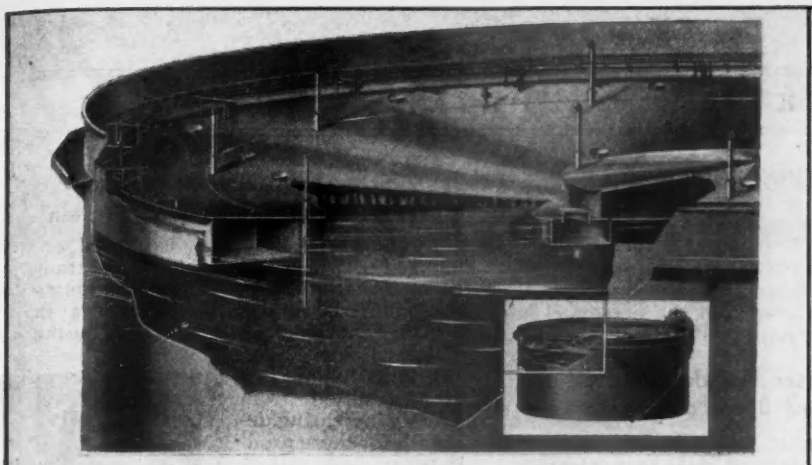
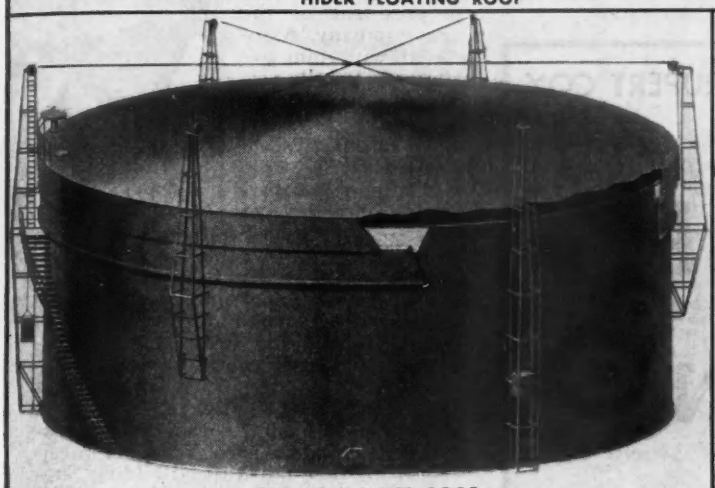
71 Gooding St.,
Lockport, New York

31 Fletcher St.,
Lexington, Mass.

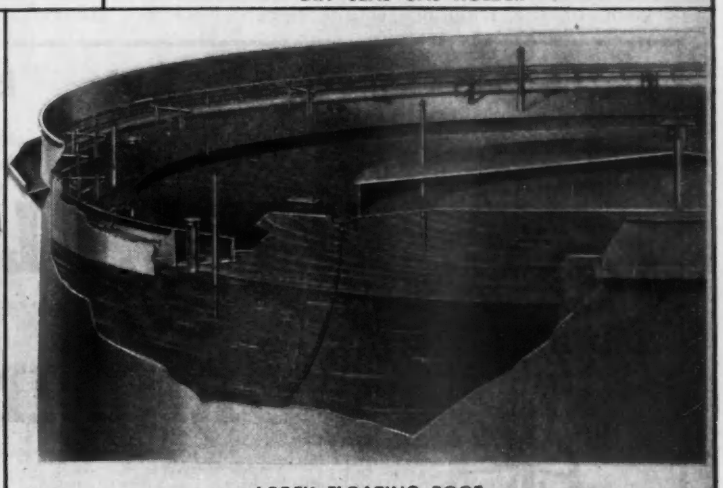


HIDEK FLOATING ROOF

DRY SEAL GAS HOLDER



DRY SEAL LIFTER ROOF



LODEK FLOATING ROOF

4 WIGGINS CONSERVATION STRUCTURES

designed to convert evaporation losses into quick profits

WIGGINS CONSERVATION STRUCTURES

- Hidek Floating Roofs
- Lodek Floating Roofs
- Balloon Roofs
- Breather Roofs
- Dry Seal Lifter Roofs
- Dry Seal Gas Holders

Executives and engineers responsible for the efficient storage and marketing of petroleum products will find it to their advantage to investigate General American Wiggins Conservation Structures.

They will learn these structures provide long-time trouble-free performance and through greatly reduced evaporation and pumping losses provide a maximum return on their investment.

Ask today for literature describing the exclusive Wiggins designs, or better still, ask a General American engineer to discuss your problem with you.

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FRANCE: Etablissements Delattre & Frouard reunis, Paris

Oilwell Names Kenton Chickering Manager of Commercial Research

Kenton Chickering, supervisor of the market analysis section since October, 1944, has been named manager of the commercial research section of Oil Well Supply Company. A 20-year employe, Chickering has been in the general sales department at the company's headquarters in Dallas for the past fifteen years.

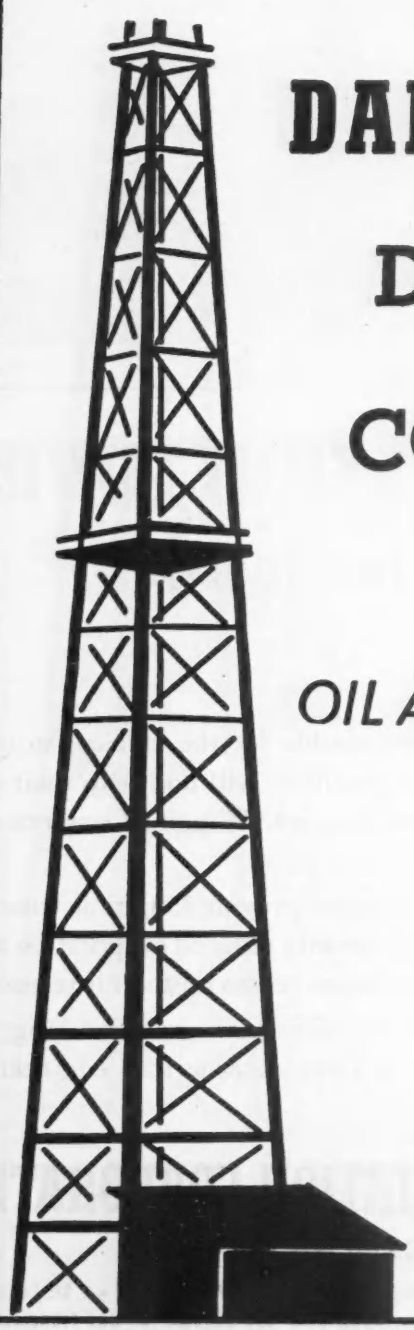
D. O. Smith, a veteran of 24 years with "Oilwell," has been appointed manager of the product development and improvement section. He has been supervisor of the training section since coming to the general sales staff in June, 1945.

R. L. Humphrey, tubular representative in Oil Well Supply Company's Gulf Coast Division headquarters at Houston since September, 1947, has transferred to Dallas as manager of the personnel and training section.

Byron Jackson President Elected To Lockheed Board of Directors

E. S. Dulin, president of the Byron Jackson Company has been elected a member of the board of directors of Lockheed Aircraft Corporation.

DAN L. CLARK W. M. AVERILL RUPERT COX



DAN L. CLARK

DRILLING

COMPANY

Drillers of

OIL AND GAS WELLS

POWER AND STEAM RIGS

WILSON BUILDING

CORPUS CHRISTI, TEXAS

Telephones

Local 7746—7747 Long Distance 95

John F. McComb Named President Of New McRan Company in Houston

The McRan Company has been organized in Houston to handle Stran-Steel framing and Quonset buildings for industrial and commercial use in Texas. Franchisement of the firm by the Great Lakes Steel Corporation of Detroit resulted from greatly increasing demands for these products.

John F. McComb

John F. McComb is president of the new company. Associated with him are Henry E. Randle, vice president; Adolph Stuermer, secretary; and W. F. Weed, treasurer.

McComb was formerly director of sales for the Stran-Steel division of the Great Lakes Corporation and has also been associated with Continental Steel Corporation of Kokomo, Ind. Randle has been associated with Stran-Steel since 1936 and has been Houston district manager of several years.

Steurmer has been with Great Lakes Steel Corporation for seven years, most recently as assistant to Randle in Houston district opeartions. Weed is president of the Pre-fabricated Building Supply Company of Beaumont and chairman of the board of the Lower Neches Valley Authority.

John G. Seiler Elected Executive Vice President of Tube Turns, Inc.

John G. Seiler has been elected executive vice president of Tube Turns, Inc., Louisville, Ky. Seiler became associated with Tube Turns, Inc., in 1930, and a year later he was appointed sales manager. He was made vice president at the beginning of World Ward II and general sales manager in February, 1945.

John G. Seiler

Kaye & MacDonald, Inc., Purchases American Chain & Cable Division

Kaye & MacDonald, Inc., West Orange, N. J., makers of the K-Master line of steam specialties, have purchased the Julian D'Este Division of the American Chain & Cable Company.

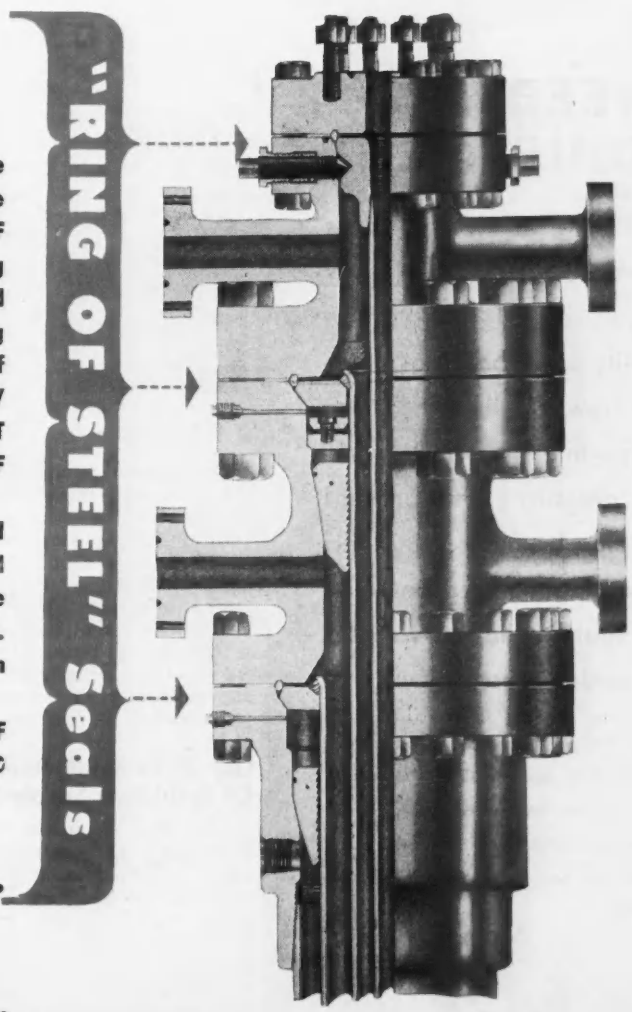
Julian D'Este Company is one of the oldest steam specialty concerns in the country, having been established in Boston in 1871. The entire D'Este line will be modernized and added to the K-Master line of steam specialties.

Machinery, work in process, tools, jigs, and fixtures of the D'Este Division are being transferred to West Orange and will be combined with the facilities of Kaye & MacDonald, Inc. The present D'Este sales organization is expected to be retained.

A CHAIN IS NO STRONGER THAN ITS WEAKEST LINK . . . .

and your CHRISTMAS TREE

IS NO SAFER THAN IT'S BETWEEN STRING SEALS



There's no percentage in using highest grade casing . . . finest quality tubing . . . first-rate tree fittings unless you follow through with "RING OF STEEL" seals available only with RECTORHEAD casing and tubing heads. Innumerable tests have proved the "ring of steel" seal capable of withholding pressures 50% greater than the test pressure of the heads. THUS THE WEAKEST LINK IN THE "FLOW CHAIN" OF YOUR WELL BECOMES THE STRONGEST WHEN YOU USE RECTORHEADS WITH "RING OF STEEL" SEALS.

The RECTORHEAD "RING OF STEEL" seal (a good weld plus API ring gasket) is the safest of all and easiest to install. Your regular welder can make the weld in one hour or less on any grade of pipe. Weld or welding ring is never subjected to strain or tension, even when tightening flange bolts.

Protect your well investment, with "RING OF STEEL" seals by using RECTORHEAD CASING AND TUBING HEADS.

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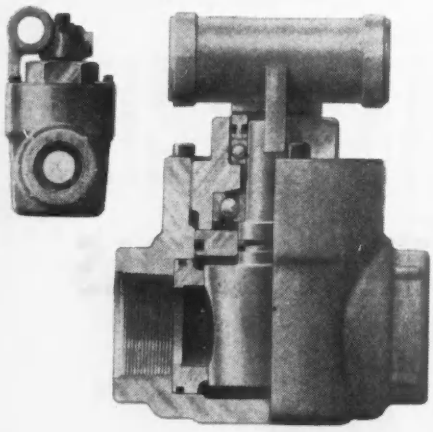
RECTORHEAD

MAKING THE OIL INDUSTRY SAFER!

ASSOCIATION WELL HEAD Equipment MANUFACTURERS CERTIFIED

TANNER HIGH PRESSURE VALVES

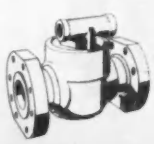


NEED NO ADJUSTMENT

The plug in this valve is non-adjustable and is firmly seated at all times. High quality ball bearings take the upward thrust of the plug while the valve is under pressure, and prevent the plug from dropping and becoming wedged between the seats while the valve is not under pressure.

These valves are used in DRILLING, CEMENTING and PRODUCING. Available in either flanged or screwed ends. Valve sizes range from 1" to 4".

Write for our catalog for complete details.



C. L. TANNER CO.

6887 Farmdale Avenue

North Hollywood, California

International Derrick & Equipment Company Makes Three Promotions

Wm. O. Cook has been promoted to assistant general manager of the Texas Division of International Derrick and Equipment Company. He has been chief engineer since 1938. Cook received his B.S. in mechanical engineering from Rice Institute in 1934 and immediately thereafter joined the engineering staff of Ideco at Beaumont.

Wm. O. Cook

A. R. McLerran has been promoted from the position of assistant chief engineer to that of chief engineer of the Texas Division. McLerran received his B.S. in mechanical engineering from the Agricultural and Mechanical College of Texas in June, 1939, and joined the Ideco organization at Beaumont immediately after graduating. His first few months with Ideco were spent in the machine shop to gain practical experience before taking on assignments in the machine design department. In August, 1944, he was promoted to the position of assistant chief engineer of the Texas Division.

A. R. McLerran

M. E. Horn

M. E. Horn who has been field service engineer for Ideco since September, 1944, has been moved to Beaumont, where he will be in charge of field service for the Beaumont plant under the supervision of the Central Service Department in Dallas.

Guy A. Tompson Named President Of Bethlehem Supply Company

Guy A. Tompson has been named president of Bethlehem Supply Company. Before joining Bethlehem, Tompson was with Cities Service Oil Company for 20 years. He has been an executive of Bethlehem Supply Company since its formation, serving first as vice president in charge of sales and later as vice president and general manager.

Other promotions announced by A. M. Homer, president of Bethlehem Steel Corporation, of which Bethlehem Supply Company is a subsidiary, include C. R. Zimmerman to executive vice president; J. F. Eaton to vice president in charge of manufacturing; and I. C. Smith to general manager of sales.

The Fuller Manufacturing Company Opens Factory Branch in Oakland

The Fuller Manufacturing Company, Kalamazoo, Mich., has established a wholesale factory branch at 1060 East 11th Street, Oakland, Calif.

The new branch will include headquarters for sales in the 11 western states and British Columbia.

E. L. King, Western District manager, is in charge of the branch. He is assisted by personnel transferred from the Kalamazoo office.

Dearborn Chemical Company Appoints Rolston to Handle Southwestern Sales

F. E. Rolston has been assigned to the territory previously covered by Tom Holcombe for Dearborn Chemical Company. Rolston will cover Louisiana, Arkansas, and part of eastern Texas, and will be temporarily located at the Shreveport office.

F. E. Rolston

Rolston joined the staff of Dearborn in 1945 as a packaging engineer and is considered an authority on the development of specialized, moisture-proof packaging. From 1942 to 1945 he served the government as an industrial specialist, working under the Forest Products Laboratories. Assigned to the Chief of Ordnance office, he was head of the Spare Parts and Packaging Branch of the Engineering and Manufacturing Division.

Before specializing in wrapping and packaging, Rolston was associated with the Chicago Mill and Lumber Company and was president of the Rolston Engineering Company.

Clark Bros. Names M. J. Galpin As European Representative

M. J. Galpin of London, England, has been appointed European representative for Clark Bros. Company, Inc., of Olean, New York, and the International Derrick & Equipment Company of Columbus, Ohio, and Dallas, Texas. Galpin spent several weeks in the United States recently, preparatory to assuming his duties abroad. Before joining the above two organizations, Galpin was with the Anglo-Iranian Oil Company for nine years and the Roumanian Oil Industry for six years. In the late war, he served with the British Army from 1940 to 1946 as a lieutenant colonel. He is a graduate of Trinity College, Oxford University.

M. J. Galpin

Sure Sign

OF EFFICIENT EMULSION-BREAKING

Your Visco Representative has some interesting figures on Visco performance that may be valuable to you . . . Ask him to show them to you — soon.

VISCO PRODUCTS COMPANY
INCORPORATED
City National Bank Building
Houston 1, Texas

Visco

DEHYDRATING AND DESALTING CHEMICALS

NOTICE: Visco Products Company is authorized to manufacture and sell Visco Oil Treating compounds for use in the breaking and resolving of oil emulsions, and to grant licenses for such use, under the following United States patents: 1,968,582; 1,968,583; 1,975,520; 1,975,758; 2,050,659; 2,050,660; 2,208,583; 2,214,783; 2,214,784; 2,225,189; 2,303,414; 2,307,813; 2,318,454; 2,318,455; 2,323,056; 2,328,544; Re. 20,712 and patents pending. Any purchaser of Visco oil treating compounds is authorized to use the same in the treating, breaking and resolving of oil emulsions in accordance with the above patents. The royalty for such use is included in the purchase price. Visco Products Company is authorized to and is willing to grant license on a royalty basis, to all companies, and to others desiring to practice the patented subject matter, under any and all of the above patents, permitting the user to purchase the oil treating compounds at will from any vendor, and to prepare the compounds for use under the above patent or patents, at a royalty charge of 50 cents per gallon. Application for license should be made to Visco Products Company, Houston, Texas.

H. B. Catlow Elected to Succeed Judd as Republic Supply President

H. B. Catlow has been elected president of Republic Supply Company. Catlow, formerly vice president and manager of sales, succeeds A. B. Judd, who has resigned to enter business for himself. Don L. Collins, executive vice president, continues in the same capacity. Other officials of Republic are J. H. Brooks, Tulsa, vice president, and John Lollar, Jr., Houston, secretary and treasurer.

Catlow has been identified with the supply business since his connection with Republic Supply Company in 1942. He came to Republic Supply from Republic Steel Corporation, former owner of Republic Supply Company. He has been located in Houston since 1937 and has been associated with Republic Steel since 1923.

Judd has been with Republic Supply since 1922 and resigned to organize his own company with headquarters in Houston. He will continue to serve as a member of the board of directors.

Designed especially for "tough going," AMERICANS have what it takes to render smooth, dependable service in heavy industrial applications. Strong, precision built, longer lasting, they will minimize your anti-friction bearing problems. Our technical staff will assist you in selecting the right bearings for your needs. Write.

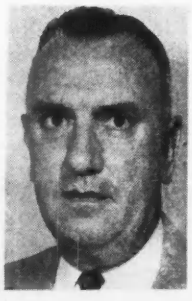
AMERICAN ROLLER BEARINGS

AMERICAN ROLLER BEARING CO.
420 Melwood Street Pittsburgh, Pa.

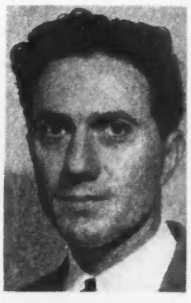
Pacific Coast Office: 1718 S. Flower St., Los Angeles, Calif.

Wilson Named Chief Metallurgist For Cameron Iron Works in Houston

D. E. Wilson has been appointed chief metallurgist for Cameron Iron Works, Houston, and G. E. Nevill has been named senior development engineer.



D. E. Wilson



G. E. Nevill

Wilson has served as chief metallurgist for the Edwards Valve Manufacturing Company and for the Studebaker Corporation, Aviation Division, Chicago. Prior to joining the Cameron organization, he was works manager for the Portland Forge and Foundry at Portland, Ind.

Nevill received his engineering degree from Rice Institute in 1928 and has held engineering positions with a number of oil tool manufacturers, including Beaumont Iron Works and National Supply Company. He resigned his position on the engineering staff of Brown Shipbuilding Company to accept his new position with Cameron.

C. F. Johnson Named Representative For Manning, Maxwell & Moore, Inc.

C. F. "Cy" Johnson has recently joined Manning, Maxwell & Moore, Inc., whose main offices are in Bridgeport, Conn. Johnson will have his office in Houston and will function as special representative. He will also contact all phases of the oil industry with special emphasis on broadening the usefulness of the company's products in that industry with a view to adding to these products.

C. F. Johnson

After receiving his degree in mechanical engineering at the Rice Institute in Houston, Johnson became associated with the Reed Roller Bit Company, where he remained for a number of years and became manager of the valve division. In 1943 he acceptde the position of manager of the Valve Division for Security Engineering Company of Whittier, Calif., at which time he moved to the West Coast. Later, he became chief engineer of the Distributor Products Division of Watson-Stillman Company, Roselle, N. J., and also served as their representative in contacting the trade.

Only IN W-K-M VALVES

Seals in both open and closed position by parallel expansion directly across both seats . . . not by jamming or wedging into a tapered body and without any distortion whatever.

After reaching open or closed position, a slight movement of the handwheel expands this double tapered gate outwardly against the two over-size seats forming *a perfect seal on both sides*. Then, the first opposite movement of the wheel collapses the gate, away from the seats, sufficiently to allow the valve to be opened or closed without effort . . . against full rated pressure.

Chrome plated gates for resistance against corrosion add materially to the ease of operation of W-K-M Valves.

This is another of the several reasons why you may be sure that a W-K-M Valve will always effect a complete shut-off . . . will always open or close under full rated pressure.

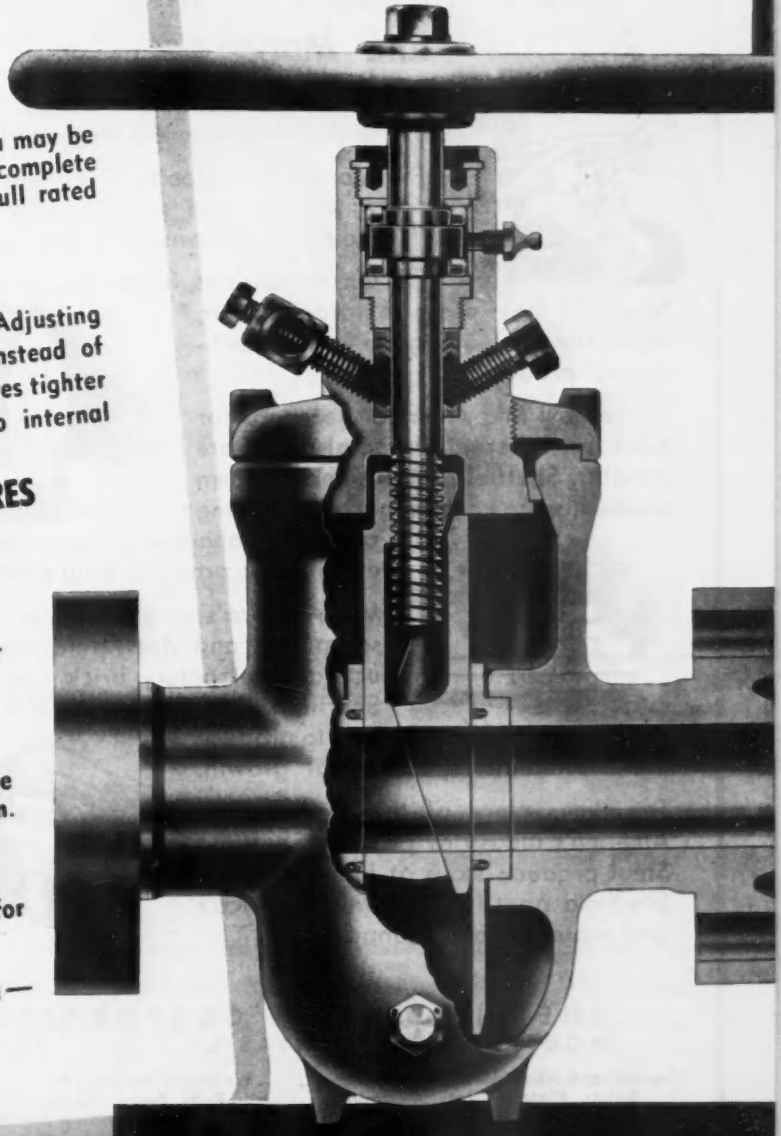
PRESSURE SEAL BONNET

Requires no flanges — no studs and nuts. Self-Adjusting to pressure and temperature changes . . . instead of tending to push bonnet off, greater pressure gives tighter seal . . . considerably less area exposed to internal pressure.

PLUS THESE OTHER PROVED FEATURES

- Lubricant contained in entire body — no special lubricant required — seal does not depend on lubricant.
- Through — conduit opening — no turbulence — no restriction of flow.
- Oversize bronze renewable seats
- Combination wipe and seal rings keep the gate clean . . . pressure out . . . grease in.
- Chrome plated gates.
- Double roller thrust bearings on stem for ease of operation.
- Combination plastic-chevron packing — uses no gland or gland follower.

THIS PARALLEL EXPANDING GATE SEALS DIRECTLY ACROSS BOTH SEATS



THIS IS THE NEW - IMPROVED W-K-M FLOW-LINE AND CHRISTMAS TREE VALVE

W-K-M Company, Inc.

OIL FIELD, PIPE LINE & INDUSTRIAL EQUIPMENT

HOUSTON, TEXAS, U. S. A.
LOS ANGELES

Cable Address: "WILKOMAC"
Export Office: 30 Rockefeller Plaza, New York, N. Y.

EAST OF THE ROCKIES . . . WEST OF THE MISSISSIPPI

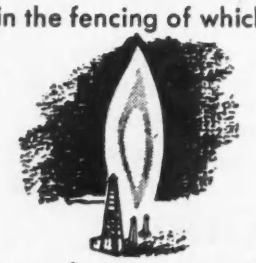
SHEFFIELD STEEL

Mid-America's Own Mills Make Steel with Mid-America's Own Materials and Manpower

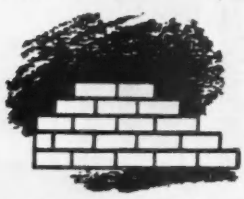
East of the Rockies and West of the Mississippi—still the great American Frontier.

Along the railroads in the building of which Sheffield supplied steel, great industrial expansion is taking place.

On the prairies, in the fencing of which Sheffield Steel plays so large a part, agriculture is leading the way in mechanized production.



In the new Mid-America the needs for steel are different, the total needs are greater. Sheffield, Mid-America's own steel mills, are keeping pace—producing a greater tonnage and a greater variety of steel products than ever before.



Mid-America's own resources such as scrap iron and steel, petroleum products and refractory brick are used in Sheffield Steel making. Mid-America's own manpower is employed to produce the B-Vitamine of industrial growth.

Ten times more of the money Mid-America's industries pay for Sheffield Steel products stays at home because Sheffield pays it out for Mid-America's own materials and manpower.

SHEFFIELD STEEL CORPORATION
HOUSTON KANSAS CITY TULSA

Carbon and Alloy Steel, Ingots, Blooms, Billets, Plates, Sheets, Merchant Bars, Steel Joists, Structural Shapes, Road Guard, Reinforcing Bars

Welded Wire Mesh, Wire Products, Wire Rods, Fence, Spring Wire, Nails, Rivets, Grinding Media, Forgings, Track Spikes, Bolt and Nut Products

SALES OFFICES: Chicago, Ill.; St. Louis, Mo.; Des Moines, Ia.; Omaha, Nebr.; Wichita, Kans.; Denver, Colo.; Oklahoma City, Okla.; Dallas, Tex.; San Antonio, Tex.; Lubbock, Tex.; New Orleans, La.; Shreveport, La.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Goodall Rubber Company Appoints Garratt Special Representative

John N. Garratt has joined the sales force of the Goodall Rubber Company as special representative in charge of promoting Flexo rotary hose sales. Garratt received his degree in civil engineering from the Newark College of Engineering and studied sanitary engineering at Massachusetts Institute of Technology. From 1938 to 1948 he was associated with Wallace & Tiernan, Inc., as sales engineer for the Gulf Coast Territory.

John N. Garratt

Koppers Company Names Fred C. Foy Vice President and Sales Manager

Fred C. Foy, vice president of J. Walter Thompson Company, has accepted an appointment as vice president and manager of the sales department, central staff, of Koppers Company, Inc.

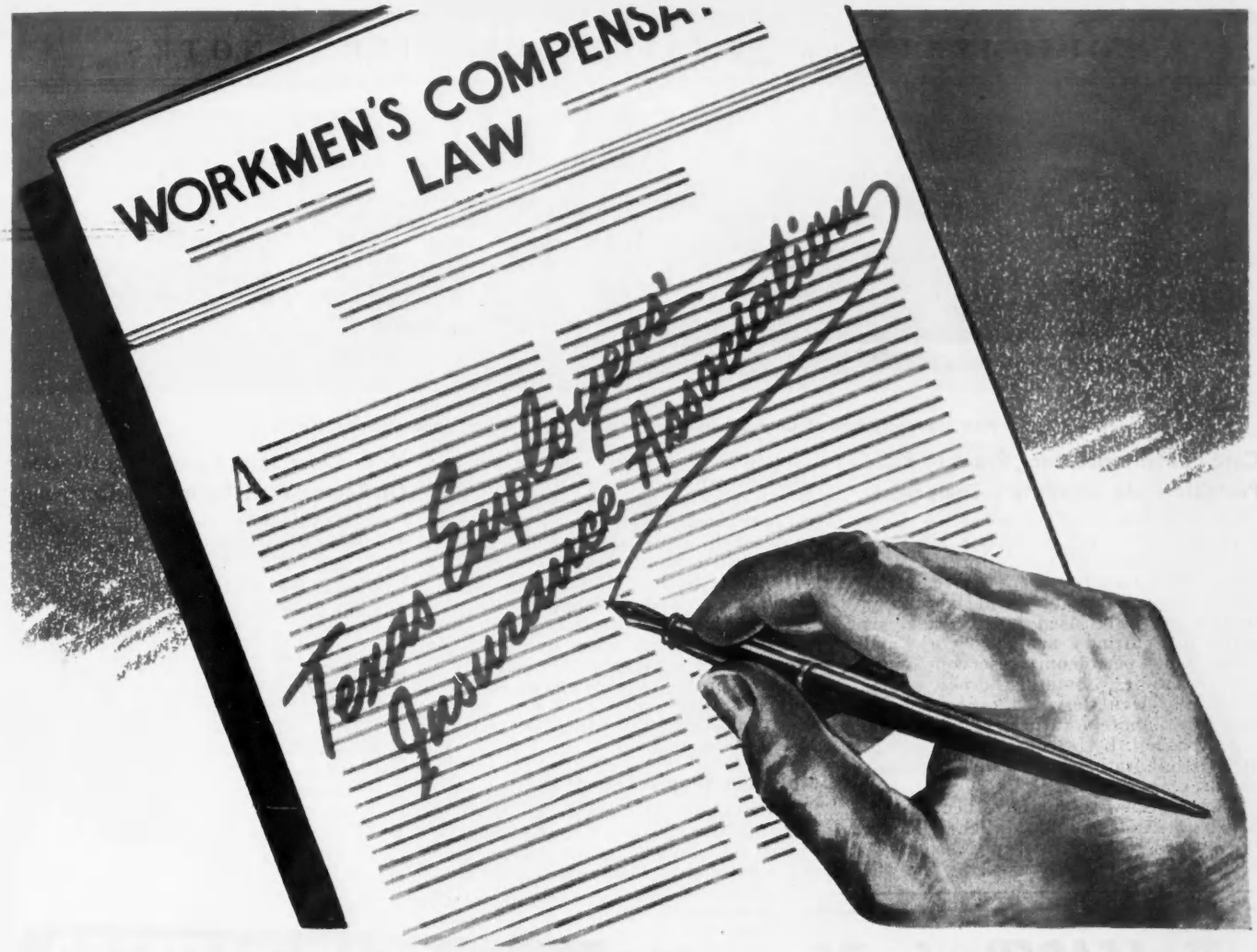
As general manager of the Detroit office of the Thompson organization, Foy has been supervisor of all phases of the Ford Motor Company advertising, which is handled by that agency. He will assume his new duties at Pittsburgh headquarters of Koppers on August 1.

Foy has been associated with the Joaquin Light and Power Corporation at Fresno, Calif., where he was manager of the public relations department. He first joined the J. Walter Thompson Company in 1930 and left in 1933 to join their client, Shell Oil Corporation, as advertising manager, where he remained for several years. Immediately before the war he was associated with Young & Rubicam, Inc., advertising agency as account executive on the Gulf Oil Corporation account. He has been manager of the Detroit office of J. Walter Thompson since November, 1945.

Foy's appointment fills a vacancy created last April 1, when E. J. McGehee, vice president and sales manager of Koppers, was assigned responsibility for the company's wood preserving activities in the western half of the United States. Ralph Winslow, Koppers' director of public relations, who has been serving as acting manager of the sales department, will continue to guide activities of both departments until Foy takes up his new duties.

John H. Matthews Elected to Board Of Canadian Raybestos Company, Ltd.

John H. Matthews, vice president and director of Raybestos-Manhattan, Inc., was elected to the board of directors of The Canadian Raybestos Company, Ltd. Matthews is in charge of the Manhattan Rubber Division at Passaic, N. J. He has been with Manhattan since graduation from Stevens Institute of Technology in 1914.



SERVICE FACILITIES

The Texas Employers' Insurance Association maintains facilities whereby employers of labor in Texas can secure complete and highly specialized Workmen's Compensation Service, including:

- **Nineteen district service offices.**
- **Proved financial responsibility.**
- **Qualified rating and underwriting "know-how."**
- **Prompt handling of claims.**
- **Texas' largest insurance safety engineering organization.**
- **Insurance at cost to Texas employers.**

Written into THE LAW

When the Texas Workmen's Compensation Insurance Law was enacted in 1913, the Legislature recognized the need for setting up an organization to assure its proper administration. So Article 8308 creating the Texas Employers' Insurance Association and defining its duties and powers was written into the law.

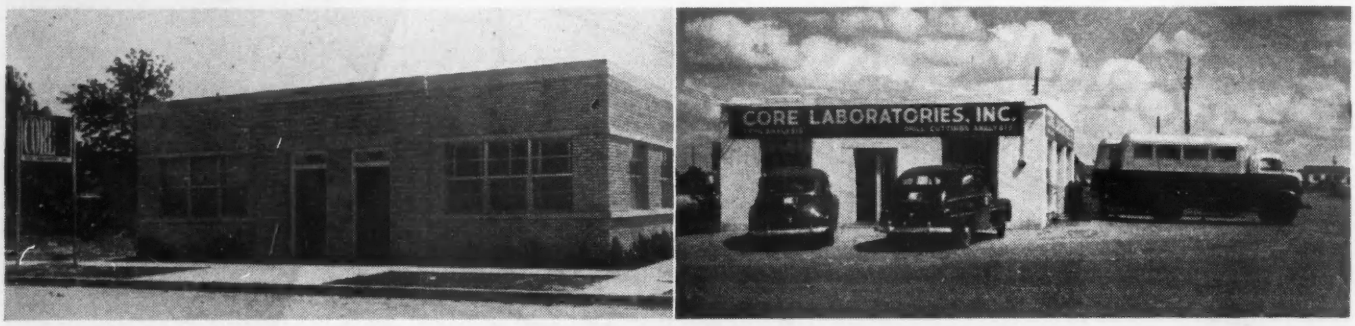
It was given general corporate powers and its management and direction was placed in the hands of a board of directors, the first of which was to be appointed by the Governor, but all future boards were to be elected by the policyholders of the Association.

Thus the Association was created, and charged by the Compensation Law with the responsibility of providing employers of labor in Texas with Workmen's Compensation Insurance Service.

TEXAS EMPLOYERS INSURANCE ASSOCIATION

Home Office: DALLAS • *District Offices in:* ABILENE • AMARILLO • AUSTIN • BEAUMONT • CORPUS CHRISTI • DALLAS • EL PASO • FORT WORTH
GALVESTON • HARLINGEN • HOUSTON • LUBBOCK • MIDLAND • PORT ARTHUR • SAN ANTONIO • SHERMAN • TYLER • WACO • WICHITA FALLS

HOMER R. MITCHELL, *Chairman of the Board* A. F. ALLEN, *President*



New stationary labs of Core Laboratories, Inc., at Abilene (left) and Midland, Texas.

Core Laboratories, Inc., Plans to Build Portable Field Laboratory Equipment

W. H. Davison, president of Core Laboratories, Inc., Dallas, has announced plans which call for the construction and improvement of over $250,000 worth of portable field laboratory equipment to be used in core analysis and drill cuttings analysis work and subsequent petroleum reservoir engineering studies. Some of the new equipment has been designed especially for use on off-shore locations. This will be accomplished by setting a completely unitized laboratory on the drilling company's operating barge.

New stationary labs have been established at Abilene and Midland, Texas, the latter location being especially equipped for making complete analysis of fractured lime. Other Core Lab installations which have moved into new and enlarged quarters and will serve as both permanent labs and base points for portable field units used in core analysis and drill cuttings analysis work, include Lafayette, La.; Corpus Christi and Tyler, Texas; and Oklahoma City.

Davison has also announced an employe profit-sharing plan by which a large fixed percentage of the organization's net profits, before taxes, will be returned at the end of each year to be divided among all operating and administrative personnel.

Bethlehem Supply Promotes Bay

Thomas Bay Jr., former chief clerk for Bethlehem Supply Company in the Central Oklahoma district office, has been promoted to field representative.

V. R. Cloer Joins Cementing Division Of Rector Well Equipment Company

V. R. Cloer has joined the cementing Division of the Rector Well Equipment Company. Cloer has had experience in the oil industry, having started with the Sargent Engineering Company in 1937. Since that time he has been with McQueen and Clevenger, drilling contractors, Rowen Drilling Contractors, and the West Texas division of the Gulf Oil Company.

V. R. Cloer

The LEADER...for 25 years!

MILLER SAND PUMPS

And Regular Bailers

- **Thousands of MILLERS in use Throughout the World!**
- **The Standard Clean-out Tool!**

O. D. Sizes on MILLER SAND PUMPS are: 2½, 3, 3½, 4¼, 5, 5½ and 7 inches. Lengths are 20, 25 and 30 feet. The bail is welded to heavy seamless steel tube. Long heavy grooved plunger assures a liquid seal. Has three interchangeable bottoms. Wire line is direct connected to plunger—gives greater suction. DOES THE JOB! FAST! ECONOMICAL!

MILLER REGULAR BAILERS are made in 2½, 3, 3½, 4¼, 5, 5½ and 7 inch O.D. sizes and in 20, 25 or 30 foot lengths. Sectional Bailers made to your specifications. See Composite Catalog, page 2666, for prices, parts and details.

MILLER SAND PUMP CO.

1524 SE 29th Street
BOX 4516, OKLAHOMA CITY, OKLAHOMA
Export Office
30 Rockefeller Plaza, New York 20, N. Y.

THOMPSON-HAYWARD FORMALDEHYDE *Reduces* CORROSION

- Save on Pulling Costs
- Save on New Steel
- Save on Shutdown Time
- Low Cost
- Dependable
- Field Tested

Protect expensive and hard-to-get steel parts from hydrogen sulphide corrosion and corrosive mine and well waters, with Thompson-Hayward Formaldehyde.

Warehouse Stocks Available For Prompt Shipment

THOMPSON-HAYWARD CHEMICAL CO.

DALLAS WICHITA HOUSTON TULSA NEW ORLEANS DENVER SAN ANTONIO

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Kobe, Inc., Appoints John Hopkins Manager of Consolidated Districts

Consolidation of the Los Angeles Basin and Coastal districts under the managership of John Hopkins is announced by Kobe, Inc. Hopkins, who joined Kobe in 1946 after wartime service in the U. S. Navy, has been Coastal District representative for the past year. The headquarters of the combined districts will be in the Wilson Building, Huntington Park.

Hopkins will be assisted by Howard Sweet, who until recently has been a member of Kobe's Technical Service Division.

John Hopkins

Ray Elner

Ray Elner, district manager for Kobe, Inc., in the Los Angeles Basin for the past three years, has been promoted to assistant to Russell G. Ralph, Mid-Continent Division Manager. He will have charge of company contacts in the Fort Worth and Dallas areas and will also handle such other sales and technical operations in the Mid-Continent as may be assigned by the Division Manager.

Elner began his production experience with the Standard Oil Company of New Jersey in Venezuela. He first joined Kobe, Inc., in 1934, working out of the California office.

Bowman Appointed Vice President Of Earle M. Jorgensen Company

Delmer Q. Bowman has been appointed a vice president of Earle M. Jorgensen Company and made district manager at Houston.

Delmer Q. Bowman

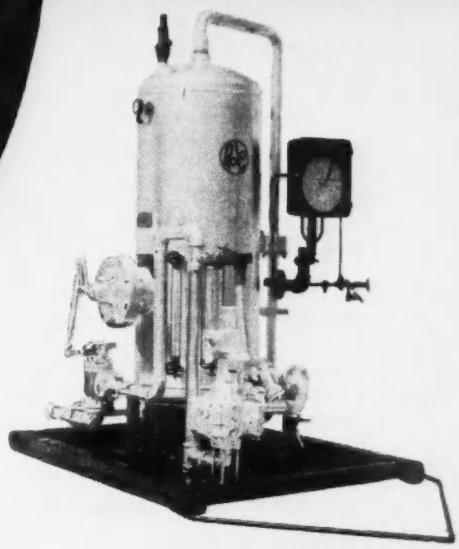
Bowman started work at the Jorgensen company's Los Angeles plant in 1935 and in May, 1938, he was transferred to the Houston plant, where he was advanced to the sales force after intensive training.

The Houston plant which he now heads was opened in January, 1936, with a small office building and one bay containing about 17,000 square feet of floor space. It now consists of five bays and a modern office building—total area over 98,000 square feet. A contract has been let for the addition of a second story to the office building and plans are under way for the addition of two bays to the warehouse.

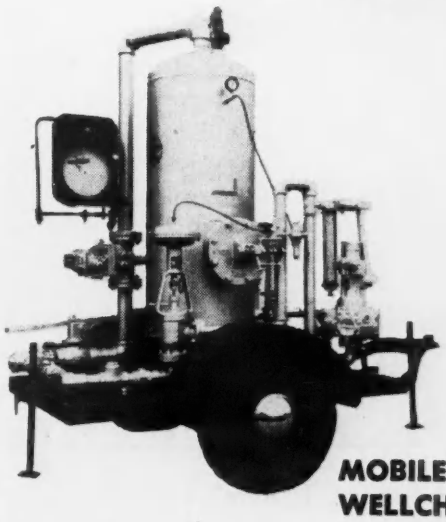
THERE'S ONLY

One

ROLO WELLCHECKER



PERMANENT WELLCHECKER



MOBILE WELLCHECKER

When considering the problem of individual well testing, drill stem tests, or royalty payments, consult ROLO, the originators of portable wellcheckers. You can profit by our experience in the manufacture of wellcheckers for gas-lift, flowing and pumping wells in fields all over the world. Used by 23 majors, numerous independents, and approved by regulatory bodies. Write for illustrated catalog.

ROLO

MANUFACTURING COMPANY

2510 SOUTH BLVD., HOUSTON 6, TEX.

EXPORT OFFICE:

R. S. STOKVIS & SONS, INC.

17 BATTERY PLACE, NEW YORK, N. Y.

Here's why World Oil is wanted by so many oil men —

SECTIONALIZED editorial content . . . six sections, each with its own separate cover and each devoted to a special phase of the oil industry.

ANALYSIS of the effect of the month's news on the industry generally, rather than straight news reporting.

PRACTICAL articles written by oil men of authority who are particularly fitted to write on the subjects in which WORLD OIL readers are interested. (During the past 12 months, WORLD OIL, known a part of this time as The Oil Weekly, carried such articles from 208 different authors.)

WORLDWIDE COVERAGE by the globe-trotting staff writers who pioneered reporting of oil developments —covering every oil producing country in the world.

INTERPRETATIVE and operating articles prepared by WORLD OIL'S editorial staff of full-time editors and writers representing a total of 130 years of oil country publishing and editorial experience—the largest concentration of oil publishing experience in the industry.

BREVITY in that the articles are written to be read and understood through the fewest possible number of words without sacrificing completeness.

WORLD OIL
Established 1916 as The Oil Weekly

PUBLISHED MONTHLY

Edited for and read by men of authority in the drilling, producing, pipe line industry throughout the world.

BOX 2608 • HOUSTON, TEXAS

I want to receive WORLD OIL. Here's my check for

☐ 3 years for $4; ☐ 2 years for $3; ☐ 1 year for $2

NAME_____ POSITION_____

COMPANY_____

STREET & NO._____

CITY & STATE_____

Check branch of industry

☐ Drilling Contractor ☐ Individual Producer
☐ Producing Company ☐ Manufacturing
☐ Pipe Line ☐ Supply

EQUIPMENT and SERVICE SUPPLIERS' NOTES

The Bovaird Supply Company Names Batchelor General Manager of Stores

Raymond E. Batchelor has been promoted from Kansas district manager to general manager of stores of The Bovaird Supply Company. Starting as an office boy at Independene in 1923, Batchelor has had a long and varied association with Bovaird, stationed at stores in Sapulpa, Okla.; Borger, Texas; and Wichita, Chase and McPherson, Kansas. In his new position as general manager of stores he has transferred his headquarters to Tulsa.

Raymond E. Batchelor

Bethlehem Supply Company Appoints Plant and Engineering Sales Managers

H. A. Barnes, former assistant superintendent of the Tulsa plant of Bethlehelm Supply Company, has been named plant manager. Lee Fagg, former chief engineer of the Corsicana plant, has been transferred to Tulsa as manager of engineering sales. Harvey E. Davidson has been named manager of the consolidated Tulsa and Corsicana engineering plants with headquarters at Tulsa.

Franklin Supply Company Transfers Lawrence Harper to Tulsa Office

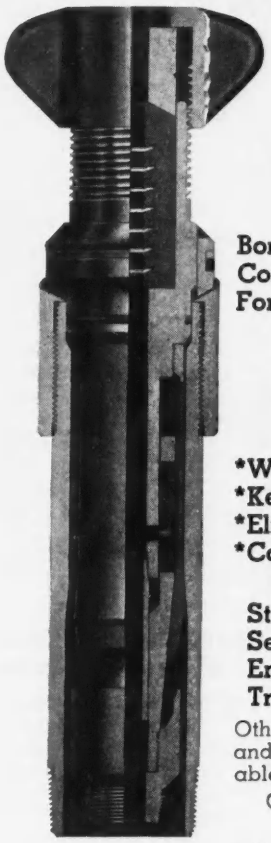
Lawrence Harper, vice president of the Franklin Supply Company, has been transferred from Chicago to Tulsa to take charge of the new office there. Harper, who has been with Franklin Supply for the last eleven years, recently served as sales manager in charge of the Michigan area. He was elected director and vice president of the company last April.

Lawrence Harper

Sales Engineers and Superintendents of Lane-Wells Company Hold Meeting

Sixty Lane-Wells sales engineers and operating superintendents met for a three day sales convention at the Blackstone Hotel in Fort Worth, Texas, June 7, 8 and 9. Under the direction of Jas. D. Hughes, sales manager, reports of company activities from all divisions were made and discussions of forthcoming services and products were explained to the sales personnel.

Morton T. Higgs, manager of field operations, gave a report on new field equipment. Val L. Forsyth, assistant chief engineer, outlined improvements and developments on equipment and products.



BOWEN
AUTOMATIC LINE WIPER No. 8000

Bore of Body	2¾"
Connection	3"
For Line sizes	3/16 to ⅞"

for

SWABBING - BAILING
WIRE LINE CORING

*Wipes the line clean
*Keeps the floor clean
*Eliminates Fire Hazard
*Conserves Oil, Gas, or Drilling Fluid
Sturdily Constructed
Self Adjusting
Entirely Automatic
Trouble Free

Other models including Casing Sizes and Special Purpose Types are available and in stock.

Complete details will be mailed on request

THROUGH YOUR SUPPLY STORE ANYWHERE

BOWEN CO. of TEXAS, INC.

Office: 2429 Crockett St., P. O. Box 1025, HOUSTON 1, TEXAS, Phone C-9457
Odessa, Texas, Phone 789—Midland, Texas, Phone 1439

THE
CAVINS
QUICK-CHANGE
ROPE SOCKET
is Ideal for:

- BAILING
- SWABBING
- WIRE LINE CORING
- SINGLE SHOT SURVEYING

Send for full particulars

THE CAVINS CO.

2853 CHERRY AVENUE, LONG BEACH 6, CALIFORNIA, U. S. A.

BRANCHES:

TAFT • BAKERSFIELD • VENTURA • SANTA MARIA

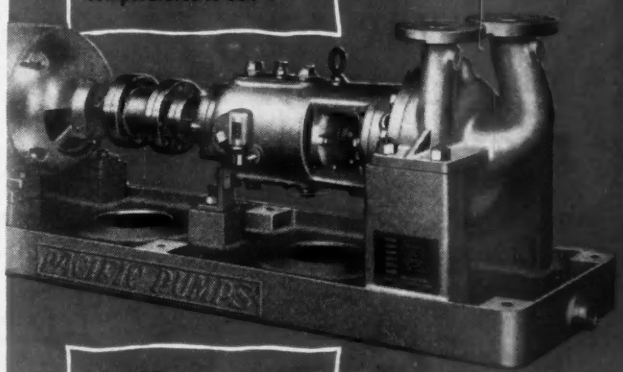
They come back for more

Refiner "A" installed his first Pacific pump in 1927. He has come back for more than 600 Pacific centrifugal pumps of all types.

In 1926 refiner "B" installed his first Pacific pump. He has come back for more than 750 Pacific centrifugal pumps of all types.

This could be repeated many more times—but there are only 26 letters in the alphabet.

TYPE SVC
Single Suction Process Pump
Capacities to 1400 GPM
Pressures to 650 PSI
Temperatures to 850°F



TYPE HV
Double Suction Process Pump
Capacities to 4500 GPM
Pressures to 625 PSI
Temperatures to 850°F

For long life—low maintenance costs—more and more refiners specify

PACIFIC
Precision Built
PUMPS

PACIFIC PUMPS INC.
HUNTINGTON PARK, CALIF.
One of the Dresser Industries
Export Office: Channin Bldg., 122 E. 42nd St., New York
Offices in All Principal Cities PR-3

B. F. Goodrich Opens Modern Science Research Center at Brecksville, Ohio

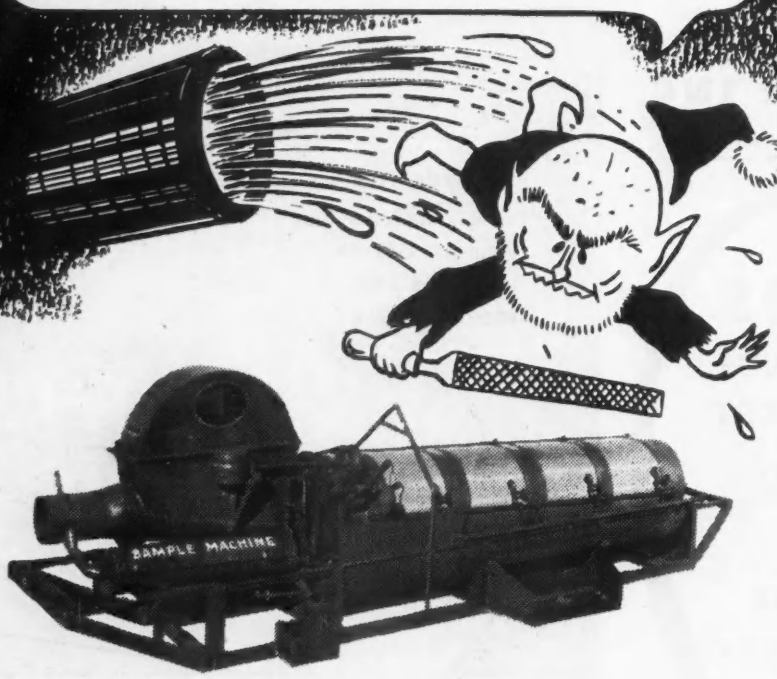
A multi-million dollar research center which, it is claimed, will make it possible to bring scientific discoveries to maturity three or four times faster than at present was inaugurated by The B. F. Goodrich Company on June 15 in Brecksville, Ohio.

The six buildings on the 261-acre site are all equipped with the latest scientific tools and equipment. In addition to probing into the mysteries of crude and man-made rubber, Goodrich will conduct intensive research in such fields as chemicals, plastics, agriculture, horticulture and the application of nuclear energy to rubber manufacturing. Atomic energy's usefulness and effects in rubber and related materials will be studied in one of the center's laboratories.

The main building of the new center is a three-story structure which contains no windows except at the ends of hallways. It is 226 feet wide, 172 feet deep, contains 81 individual laboratories, a cafeteria, assembly hall seating 250, and a 10,000-volume library, largest of its kind in the world.

"KILLER" SHALE SAYS:

HOW FAR DOWN DO YOU HAVE TO GO TO BE SAFE FROM A THOMPSON SHALE SEPARATOR?



Mud flow from the deepest wells, the largest mud pumps is handled with ease by the Thompson "DWF" Shale Separator. Shale and abrasives don't have a chance to go back into the well and damage expensive drilling equipment. Increased profits show up on the books every time when abrasives are thrown out. *Another Thompson feature* that makes money for drillers: attached SAMPLE MACHINE—standard on all models—provides accurate foot-by-foot samples of cuttings. Thompson Separators are available in three sizes, each self motivating and designed to give utmost efficiency for its capacity.

Write today for free illustrated folder containing complete data on all Thompson Separators.

THOMPSON TOOL CO.
IOWA PARK, TEXAS

KEEPS DRILLING MUD CLEAN — PROVIDES *TRUE* SAMPLES OF CUTTINGS

Appointment of A. Ray MacPherson Announced by Thermoid Company

A. Ray MacPherson

A. Ray MacPresson has joined Thermoid Company as manager of the Industrial Friction Materials Sales Division. Prior to joining Thermoid, MacPherson was sales manager of Standco Brake Lining Company of Houston.

For five years he manufactured and sold his own brake lining under the trade name of "Brake Friction."

MacPherson will make his headquarters in Detroit, Mich.

Gorman-Rupp Company Names Rupp, Buehler, and Cadigan Vice Presidents

Warren E. Rupp, Walter O. Beuhler, and Kenneth H. Cadigan have been elected vice presidents of the Gorman-Rupp Company, Mansfield, Ohio, manufacturers of centrifugal pumps.

Rupp was formerly chief engineer for the company and Cadigan was a former sales engineer. Buehler recently resigned as vice president of the Carver Pump Company.

Reed Roller Bit Company Transfers R. F. Roberts to Caracas, Venezuela

R. F. Roberts, who for a number of years was division manager of the Reed Roller Bit Company at Shreveport, Louisiana, has been transferred to Caracas, Venezuela. His new territory includes Venezuela, Colombia, Ecuador, Peru and Trinidad. He replaces T. C. Lemcke, who is returning to the U. S.

R. F. Roberts

Johnston Enterprises Organized With M. O. Johnston as President

M. O. Johnston, oil tool manufacturer in Los Angeles, has joined forces with Edgar Johnston of Longview, Texas, Texas oil operator and contractor, in the formation of the Johnston Enterprises, a Johnston family business which links Mid-Continent and California interests.

M. O. Johnston is president, Blaine Johnston is general manager, and the other owners are M. O. Johnston, Jr., Warren Johnston, E. C. Johnston, Jr., Gordon Johnston, and Glenn Johnston. The company headquarters are at 3035 Andrita Street, Los Angeles, and the manufacturing plant is located in Longview.